The FOUNDRY

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Castings Are Required for A Shave and A Haircut

MAN'S quest for facial beautification dates back to the period of the ancient Egyptians, who it is claimed by great historians, indulged in the artistic pursuit of shaving the beard and dressing the hair. The occupation of the barber is one of civilized life, and in Athens and Rome in the days when these cities were the centers of greatest learning, barbers were men of local standing for their

A Barber, a Bobber, a Lady Fair,
Mere Man Must Wait with Unshorn Hair

shops were the meeting places of the newsmongers and the gossips, who willingly communicated minute history, both of families and of state. Just when barbers first sought assistance from the casting industry in adding to the attractiveness of the tonsorial emporiums is not known, but today castings are used in the chairs and in the smaller equipment such as clippers, vibrators, and in parts of the shoe shining stands. The latest styles in bobbed hair have increased greatly the malleable castings used for clippers. The high cost of keeping the hair trimmed at the barber shop or the beauty parlor has resulted in the sale of a large number of clippers and now mother and daughter have added trimming to the manifold duties of primping.

Find Where Castings May Be Sold.

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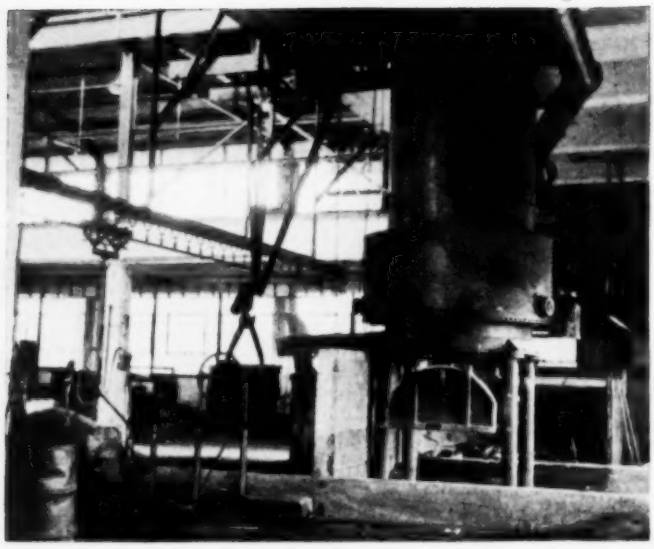


Erects Modern in Texas

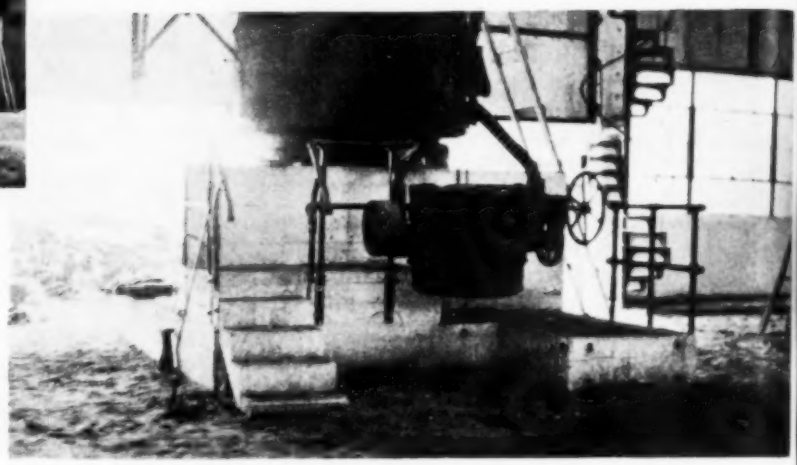


Fig. 1 (above) — A Cupola Fire Wall Protects the Operator. Fig. 2 (Right) — A Special Platform Has Been Built Before the Cupola

ONE of the finest jobbing foundries in the Southwest, if not in the entire South, recently has been completed and placed in operation by the Alamo Iron Works, San Antonio, Tex., for the manufacture of gray iron and brass castings. The building and the equipment, with the exception of cranes, conveyors, blower, and brass furnace, were designed, built and installed by that company.

Foundry and cleaning room together form an L-shaped structure; the foundry itself forming the body or upright portion of the letter and the cleaning room the leg or offset portion.

The main building is 85 feet wide and 128 feet long. It consists of a central floor 35 feet wide, flanked on either side by a floor 25 feet wide, the full length of the building. The center bay is high and the traveling cranes are 25 feet above the floor. The side bays are two stories in height with liberal head room, and surmounted by a monitor of liberal proportions, the building piles up to a height almost disproportionate to its linear dimensions. Up to and including the second floor, the building is of reinforced concrete. Beams, columns and floors alike are of liberal cross section and heavily reinforced. The walls are of hollow tile, plastered inside and out. However, there is not much of this construction except under the windows, as the wall area almost entirely is wire glass set in steel sash.

Upper portion of the building, imposed upon the concrete structure, is a steel frame covered with No. 26 gage corrugated galvanized iron and roofed with No. 24 gage of the same material. Walls above the second floor, those above the cranes in the main bay and the monitor itself are almost entirely of heavy wire glass set in steel sash. These sash in turn are provided liberally with opening sections and the monitors are the familiar one piece type with mechanical opening devices, operated by hand chains from the floor.

Deep sand covers the second floor of the west side of the building. This floor is devoted to making of light castings and the snap molders benches are located along the wall under open windows where good light and ventilation are secured.

Cores are made on the second floor of the east side of the building, at the north end. The remainder of this floor area comprises the brass molding department, where brass, phosphor bronze, and aluminum castings form the bulk of the work.

Experiences Combined

THE institution stands today a monument to the united efforts of a group of men whose hard, practical experience in general engineering and foundry practice reaches back over 40 years in Texas iron founding on the one hand, and into the acknowledged pre-eminent foundries and engineering organizations of the East on the other. This experience furnished a vast store of ideas which were checked up, sifted, harmonized and applied, each sustaining or modifying the other until the harmonious ensemble stands out a modern foundry complete to the last detail.

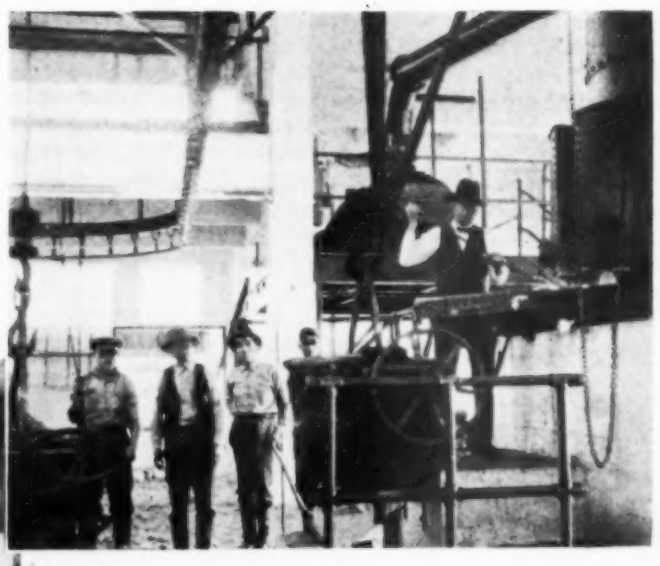
Charging Floor Large

In the new building the cupola, a 42-inch machine, stands at the south end of the main bay, directly in the center. The charging floor extends entirely across the building at a level 6 feet above that of the second floor of the side bays, and is 18 feet wide. This floor is a heavily reinforced concrete slab 5½ inches thick and is supported by massive beams of similar construction. This area, 18 feet wide by 85 feet long, is covered with a roof of galvanized iron. The coke storage bin, is at one end of the slab and is 18 feet wide and 25 feet long. It is built of formed concrete blocks and has a storing capacity for two carloads of coke. A similar area at the other end of the slab is devoted to the storage of chills, supplies and special equipment. The remaining space on the slab constitutes the charging floor around the cupola, an area 18 feet wide and 35 feet long. Materials constituting the days entire heat may be disposed of here. At present this means around 25,000 to 30,000 pounds.

A solid galvanized iron wall 4 feet high is located behind the cupola, overlooking the main floor below, and extends entirely across the bay from the corner of the coke bin to the corner

Casting Plant

By E. H. Trick



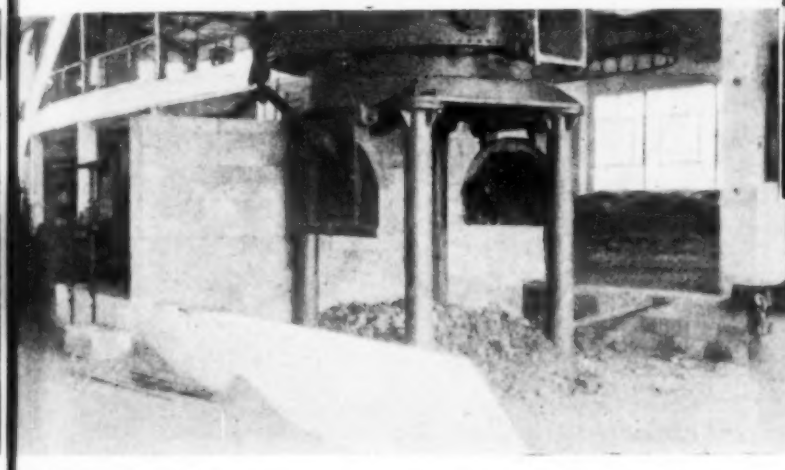


Fig. 3 (Left)—The Height of the Cupola Makes Cleaning and Patching Easy. Fig. 4 (Above)—Making the First Tap in the New Foundry

of the supply room. The entire front of the charging floor is open to the weather, except for the protection of a heavy woven wire fence along the edge of the floor.

Charges Placed In Boxes

The charges are placed along the inside of this fence and above the cupola. Each charge is composed of 1500 pounds of materials, and is handled in stoutly built plate steel boxes designed for the purpose. These boxes stand on short angle-iron legs which are long enough to permit a lift truck to be run under the boxes. Steel trunnions are riveted to their sides to permit the application of a loose bail and on one side, a heavy bronze hinged latch is riveted to the top angle. This locks the container to the bail and prevents it upsetting when being lifted by the crane.

A wall area is left open to the weather on the main floor, below the charging floor, similar to that along the charging floor itself and as the building faces south and the prevailing breeze is from that direction, that end of the building is supplied constantly with an abundance of fresh air and light. Large window areas around the building provided liberally with opening sash of the push bar type, on both the ground floor and upstairs. A double rolling door 16 feet wide and 12 feet high, is located at the north end of the main floor, directly opposite the cupola and above it, extending high above the level of the cranes, more opening sash is provided so that throughout every part of the building from main floor to monitors good ventilation and plenty of light are provided.

One may reach the charging floor by a circular staircase of all steel construction, similar to that used as a fire escape in certain types of buildings. Materials, properly classified, are stored immediately outside the south end of the building directly below the charging floor between the building and the street. A heavy jib crane is located on the edge of the charging floor, near the corner of the coke bin. The mast passes through the shed roof above and is secured to the building by fabricated steel stiff-legs. The bottom of the crane rests in a ball bearing and the top pintle is fitted with a roller bearing. The jib is 22 feet long and is double rodded to the top of the mast, one rod is secured to the outer end of the jib and one to the center, so that all deflection is prevented. This crane is sensitive and in windy weather had to be tied in a fixed position to prevent its being blown against the edge of the roof over the charging floor. This crane is fitted with an electric hoist of two tons capacity electrically welded to a heavy trolley which in turn is provided with a simple arrangement of pulleys and tiller rope so that it may be propelled back and forth on the jib simply by turning a crank attached to the mast.

Electric Hoist Lifts Charge

A small landing platform, stoutly constructed of steel, projects from the edge of the charging floor immediately in front of this crane. The platform is fenced securely on both sides and part of the way across the front, only enough opening being left to permit the free passage of the steel charging boxes previously described.

A steel scale hangs upon the lift hook of the electric hoist, and the loose bail, which is designed to fit the trunnions on the plate steel charging boxes, hangs upon the scale hook. It makes no difference whether the empty boxes are in the yard or on the charging floor when the cupola men are ready to take up the materials of the heat. The loose bail hanging from the scale hook is swung over an empty

Workmen Are Happy

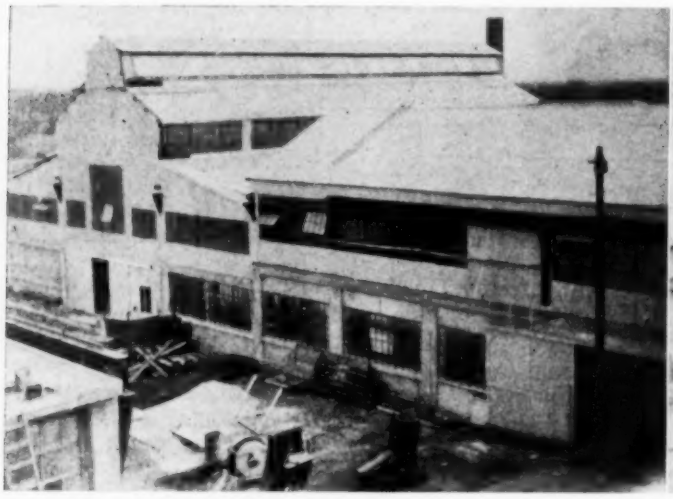
ON EVERY hand is the evidence of little things well thought out—each a trifle in itself perhaps, but in the aggregate making the place so vastly superior to the old fashioned shop the company called its foundry that the workmen hardly could be restrained when the time arrived for moving into the new buildings. For weeks before that time actually arrived, the men would hurry to eat their lunch at noon and then stroll over to the new buildings, to enjoy the mere speculation of where their particular floor would be, what new conveniences would be theirs, how they would be able to increase their production and earn more money.

charging box and hooked under the trunnions. The locking latch is flopped over and engages one of the dependent sides of the bail thus preventing the box from upsetting when it is being lifted about. The box then is swung to the different sources of materials, the scale set at each place and the various materials loaded into the container.

When the 1500-pound charge has been placed in the box the operator pulls the grip of the hoist cord and the load is lifted to the small steel platform that protrudes from the edge of the charging floor. The man on the floor racks the box in over this platform, backs a lift truck under it and lowers it onto the truck. He then releases the loose bail and racks the hoist, with the scale and bail, clear of the platform. While the man in the yard lowers the bail for another charge the man on the charging floor draws the box on the lift truck to its position in the orderly row before the cupola and lowers it to the floor.

This cycle is repeated until the entire number of charges constituting the heat have been placed before the cupola. From their positions the loaded boxes may be lifted readily by the lift truck and drawn before the charging door of the cupola and their contents discharged. The charging opening is 30 inches wide and 36 inches high and the fore plate is 20 inches off the floor. A curved steel door is provided which slides in a cast iron groove around the outside of the cupola. The door itself consists of a steel frame covered with heavy hardware cloth and serves only as a spark arrester.

Coke is stored in the bin on the charging floor as already described. Provisions for handling the coke from car to bin are modern in every respect. Coke is discharged through a chute from the car door to a steel hopper below the level of the foundry floor. This hopper is raised through a dust proof plate steel shaft to a pent house above the coke bin on the charging floor, by an electric hoist of ½-ton capacity. This hopper operates similar to that used to elevate concrete in the construction of reinforced concrete buildings. The charge weighs about 600 pounds. When the hopper is filled the operator pulls the grip of the hoisting cable, the hopper ascends, dumps the load and is stopped automatically in the pent house above. A pull on the grip of the lowering cable brings the hopper to its original position in the floor for reloading.



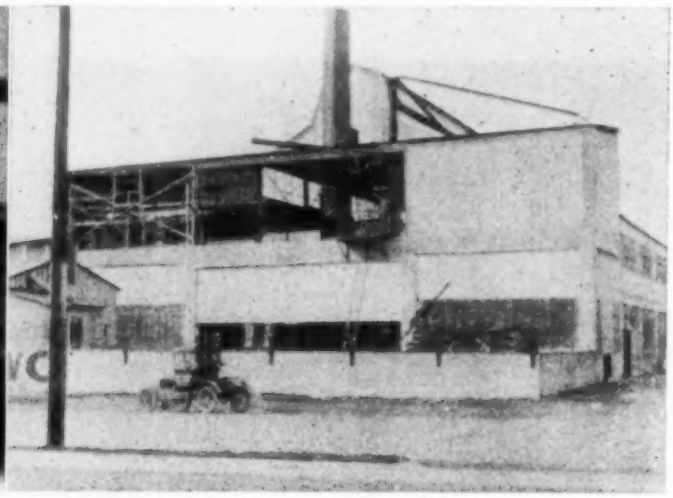


Fig. 5 (Left)—North End of the Foundry and Cleaning Room Building. Fig. 6 (Right)—South End of the Shop Showing the Charging Floor and Stock Yard

A heavy concrete wall encloses the material yard, an area 30 feet wide and 130 feet long, cutting off from traffic along the street all the unsightliness that inheres to the operation of the ordinary jobbing foundry. For this reason the place presents an exceedingly neat and orderly appearance to the passer-by.

Cupola Built High

The cupola, designed and built by the company, is 42 inches in diameter with 60-inch shell. The total height is 57 feet. The bottom is 5 feet off the foundry floor and is supported by 4 cast iron columns 5 inches in diameter. The wind-box, of liberal proportions, entirely surrounds the cupola and is provided with eight tuyeres.

Blast is provided by rotary type blower built by the P. H. & F. M. Roots Co., Connersville, Ind., and delivering through a 16-inch steel pipe made of number sixteen gage steel with electrically welded joints. This blower stands on a steel mezzanine floor 25 feet away from the cupola and directly in line with it, so that there is little loss of pressure due to friction in the pipe. The air leaves the main line through a bifurcated pipe which conveys it to the annular wind-box on opposite sides of the cupola. The end of the main air pipe is provided with an explosion valve so that if an accumulation of gas should work back into the air mains, an explosion would not damage the line or the blower.

Two overhead electric traveling cranes serve the main floor, one of 5 tons capacity and the other of 3 tons. These cranes are direct current machines.

Two side bays on the ground floor and one side bay on the second floor are provided with conveyors built by the Loudon Machinery Co., Fairfield, Iowa. Ladles of 800 pounds capacity are used on these conveyors, two of them on the main floor bays and one upstairs. The two on the main floor pass directly before the mixing ladle and receive their charge directly from it. The one used on the second floor hangs in the hook of the overhead traveling crane to receive its charge from the mixing ladle and then is elevated to the conveyor rail on the second floor and is transferred by a transfer hook.

A small steel platform similar to that used for landing the charges on the charging floor protrudes from the second floor which enables the operator to effect the transfer of the ladle of molten metal from the crane hook to that of the conveyor carriage with ease and safety. Thus the various floors in the two side bays of the first floor and the one upstairs may be poured at the same time.

The foreman's office and the pattern hospital are located at the north end of the west bay, on the main floor. The pattern hospital is an important

auxiliary to successful operation. It consists of a room approximately 14 feet square equipped with a set of broad shelves along each of two opposite sides. On a third side, its length limited by the obtrusion of the shelves on either hand, is a stoutly built work bench. This bench is furnished with a patternmaker's vise a pot of cold glue, a pot of shellac, one of black, a hammer, several chisels, pliers, an assortment of patternmaker's nails, leather fillets and a few sheets of sandpaper.

One set of shelves is devoted to patterns coming into the foundry, and the set on the opposite side to those leaving the foundry for the pattern storage. The hospital is in charge of a *handy man*, who has had a little patternmaking experience or who has at some time worked in the foundry.

When patterns are sent from the regular pattern storage building to the foundry they are taken directly to the hospital, where they are examined by the man in charge and all cracks, warps, rough spots and loose fillets are remedied. All loose core prints are nailed tight: missing loose parts are demanded from the "rustler," etc.

If a defect that demands the services of a patternmaker is discovered, the pattern is sent to the patternshop for attention. This hospital pays dividends in time and money saved. No time is lost patching a messy mold; no time consumed waiting for missing loose parts or long drawn discussion on how to get a good mold from such a bad pattern. No money is lost in bad castings for the pattern comes to the molders complete in all its parts, smooth on all its surfaces and sound throughout. The molder gets a good casting from a perfect mold, which secures contentment, the most valuable asset of all!

When the patterns are returned from the molding floors they go again to the hospital to be there a day in case an order may be found short in the count in the cleaning room. They then receive another inspection by the hospital attendant to insure their being returned to the regular storage complete in every detail.

Formerly only one large ladle was used before the cupola. All hand shanks were filled from this ladle and all left-overs returned to it. This was a confusing and unsafe procedure causing an accumulation of hand shanks on the floor before the bull ladle for the men to stumble over and the awkward situation of men having left-overs to be returned to the bull ladle when the latter was being emptied. In the new plant the bull ladle rests in a slight depression in the floor and above it permanently hangs a mixing ladle into which we tap directly from the cupola. This mixing ladle hangs in a specially designed conveyor cage which has a travel of about 3 feet. One end of the structural runway on which this conveyor travels is secured to the cupola itself while the other end protrudes into the main bay and is supported from the inside edge of the concrete charging floor above. The whole device is exceptionally simple in construction and rugged in design.

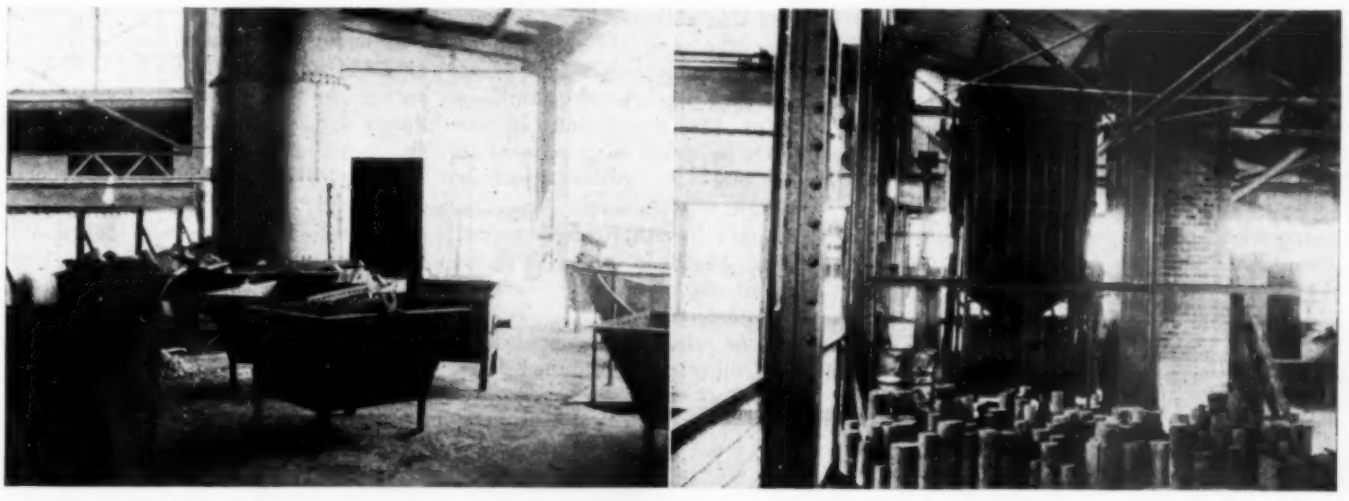


Fig. 7 (Left)—A Special Container Is Used To Carry Materials to the Charging Floor. Fig. 8 (Right)—Core Mixing Machinery Is Located on the Second Floor

An overhead conveyor rail passes the main bay directly in front of the cupola and down each side bay of the building directly inside the columns supporting the second floor. A desire to provide perfect safety led to the adoption of a continuous rail and the designing of special means for reaching the mixing ladle with the crane, hence the traveling cage for the mixing ladle. This conveyor is operated with a hand chain and may be racked forward until the ladle supporting members are in direct contact with the conveyor.

The ladle hangs on a transfer hook so designed that the overhead traveling crane may be moved up and may pick the mixing ladle off its conveyor hook with perfect ease. This transfer device consists of two parallel triangular steel plates separated at the three corners with stout shouldered steel pins. A steel hook is hung on one of these pins by a loose fitting eye. When the mixing ladle is in position before the spout the transfer device hangs by one pin in the hook of the cage, the ladle hangs in the loose hook below and the other end sticks out toward the crane hook. When the ladle is to be transferred to the crane the hook of the latter hooks into the pin protruding toward it. the crane hook rises and moves back at the same time and the ladle lifts out of its carrier and passes into direct line beneath the overhead crane hook.

The platform arrangements for the cupola tender and the ladle operator were specially designed. A concrete platform with step and protecting steel pipe railing is provided at the correct elevation for convenient operation of the mixing ladle. Similar provision is made for the man tapping out. Both platforms are concrete shell filled with earth and topped with sand. A concrete wall faced on the reverse side with fire brick protects both ladle operator and tapper in the event that the cupola tender drops the bottom before the last tap is poured into the bull ladle or the two trolley ladles.

The coreroom is on two levels, the lower level for heavy cores and the upper one for small

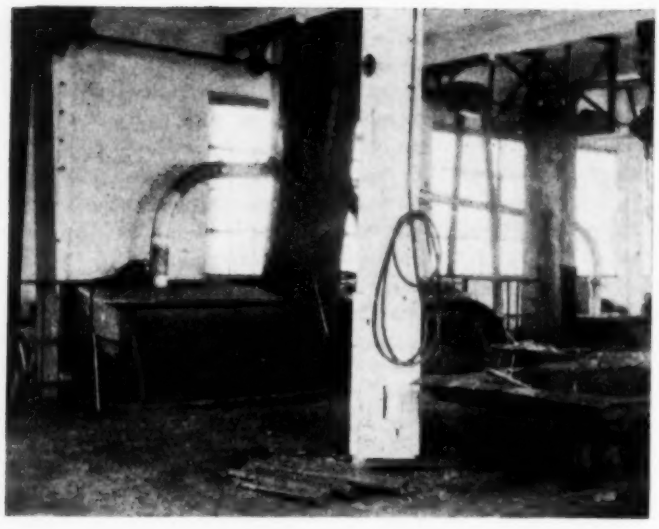


Fig. 9 — Tumblers Are Enclosed in Steel Cases To Carry Away the Dust

cores. The large core oven is in the northeast corner of the building and is 10 feet wide by 22 feet long, inside measurements, and 8 feet high at the door sloping to 6 feet 6 inches high at the baffle wall at the firing end. The oven is designed to be fired with either coal or oil, the grate arrangement being so constructed as to permit ready removal of the grates and the substitution of an oil burner. A baffle wall of fire brick 4 feet high separates the firing chamber from the drying chamber.

This wall is perforated with three rows of holes 4 inches square which pass through the wall at an angle of 35 degrees off the horizontal center line and in the direction of that side of the oven that carries the flue. This exerts a decided influence on the circulation of hot gases from the firing chamber and insures a rapid distribution of heat to uniformity throughout the entire area.

The flue is located at the side of the oven and at the center of the wall. The entrance to it is through a flue in the floor of the oven. This flue extends almost across the oven floor at right angles from the base of the chimmey and has two laterals running to within a foot of the door. These lateral flues are connected at their outer ends and the whole system of floor flues is covered with cast iron checkered plates, loosely fitted and readily removable. These plates may be shifted to suit desired draft conditions and the distribution of heat controlled to a nicety.

The wall on either side of the chimney is perforated with a double row of holes made of 1 inch steel pipe set in the brick work. These pipes carry standard couplings at their outer ends and their inner ends are flush with the inside face of the wall. These holes provide openings for the injection of a thermometer to determine the actual temperature variations within the oven at different levels and distances from the firing chamber. The oven has an asbestos lined sheet steel door, counter-balanced in the usual manner. The lift chains are at each end of the door and pass up over 10-inch chain wheels supported on brackets attached to the underside of the crane runway of the center bay.

Sand from the rattlers is elevated to a room directly above by a bucket elevator encased in a welded dustproof casing. The sand passes from the head of this elevator down a steel chute into the end of a circular screen mounted in a steel sand bin 6 feet square and 10 feet high. The tailings pass out of the lower end of the screen into a separate compartment in the larger bin. A 12-inch diameter hole through the concrete floor is located beneath the sand compartment.

A folding chute is piped beneath this hole whose normal position is horizontal, just beneath the ceiling beams of the cleaning room below. When this folding chute is pulled down by the cleaning room operator the sand is released and runs down the chute into the truck or wheelbarrow beneath.

Tailings compartment is similarly equipped with a smaller diameter chute which operates exactly like the sand chute. Some of this sand from the rattler is used in the coreroom as a component of heavy cores. The remainder is hauled away in a truck and dumped as fill in convenient places. The tailings are returned to the cupola in a wheelbarrow which is transferred along an overhead trolley.

The sand bin is provided with an overflow pipe so that when the sand reaches a fixed level in the bin the operator in the cleaning room below automatically is advised. This consists of a 3-inch pipe set vertically in the sand bin and its upper end extending to the predetermined sand level a few inches below the screen, and its lower extending through the floor.

When the sand reaches the determined level in the bin it runs into the top of the pipe and pours through the ceiling of the room below.

Last but not least is the flask storage yard. This consists of an area 70 feet wide by 94 feet long, with a concrete drive 10 feet wide along one side and a traveling crane with a 30-foot span, across the center. The heavy flasks are stacked on the area 30 feet wide by 60 feet long, served by the crane. The smaller flasks and bottom boards are stacked in neat piles outside that area. The entire yard presents an orderly, well kept appearance. Every flask is accessible and may be taken into the foundry in the minimum time.

A hot tar vat for dipping water works castings is located in a corner of the yard and is served by a pintle type jib crane of 1 ton capacity.

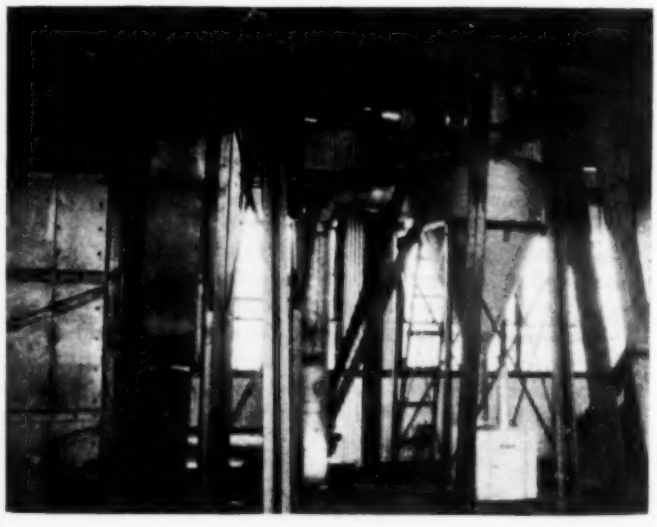


Fig. 10—A View of the Machinery Located Above the Cleaning Department

CONSUMMATED

Deflation Shown in Foundry Count

Compilation of Statistics Shows Increase in All Classes of Castings Plants Except Those Specializing in Gray Iron

EVIDENCE that the deflation period in the foundry industry is nearing completion is offered by statistics compiled from the new edition of *Penton's Foundry List*, published biannually. Since the financial stringency of 1920, when practically all manufacturers encountered a sudden cessation of demand and found themselves with tremenduously swollen inventories, both of raw materials and finished products, the watchword has been caution. Buyers have contracted only for immediate needs, supplies have been purchased on a hand-to-mouth basis and, of course, manufacturing facilities have not been expended beyond the most urgent requirements.

In the foundry industry, all this has been reflected in the reports from which *Penton's Foundry List* is compiled. The number of new plants which appear for the first time has declined. An increasing number of foundries have been found discontinued, or reporting idle. When the last previous summary of statistics from this source was published in THE FOUNDRY of Oct. 15, 1924, decreases were shown in the total number of foundries reporting, the gray iron, malleable, steel, electric steel, brass departments of gray iron foundries, and shops making aluminum. Only the exclusive brass foundries showed increases. The deflation period was making itself evident throughout the industry. A tightening was apparent all along the line.

This year's report indicates a different condition. Apparently the shaking out practically has reached completion. Although the total number of foundries listed is less than two years ago, this loss is found to be limited to the gray iron shops. Steel, electric steel, malleable, brass and aluminum shops all have increased in number. One factor which may be advanced for the loss in gray iron capacity is the rate of production obtaining in this branch of the industry. Large manufacturing companies often build and operate gray iron foundries to supply their own needs. At times they have been forced to do this by reason of the competitive demand which in many instances has limited deliveries. In times of general prosperity, when all industry is busy, such gray iron departments of large institutions can be operated profitably. However, when demand slackens, and when the production of the company operating a gray iron foundry is reduced to 50 to 60 per cent of capacity, the ever present factor of economy forces the closing of that

TOTAL FOUNDRIES IN THE UNITED STATES AND CANADA, BY STATES, AUG. 1, 1926

TOTAL FOUNDRIES IN THE UNITED STATES AND CANADA, 1924

GRAY IRON FOUNDRIES IN THE UNITED STATES AND CANADA, AUG. 1, 1926

MALLEABLE FOUNDRIES IN THE UNITED STATES AND CANADA, AUG. 1, 1926

self-operated foundry with mounting overhead costs. Then, it is more economical to buy from the jobbing gray iron shops, spreading the orders about, secure in the ability to secure deliveries at once.

This doubtless has happened in the past few years. Numerous large establishments which are doing business and making money on a scale of operation much below capacity, have farmed out their castings requirements and report their gray iron shops idle.

This effect is not evident in the reports of other classes of foundries, except perhaps in brass foundries operated as departments of other estab-

TABLE I

Iron and Steel Foundries 1926-1924

Total Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	6280
United States and Canada, 1924	6475
Total loss of foundries	195
Foundries, United States, 1926	5785
Foundries, United States, 1924	5945
Loss in United States	160
Foundries, in Canada, 1926	495
Foundries, in Canada, 1924	530
Loss, in Canada	35

Gray Iron Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	4457
United States and Canada, 1924	4564
Total gray iron decrease	107
Gray iron, United States, 1926	4044
Gray iron, United States, 1924	4135
Loss in the United States	91
Gray iron, Canada, 1926	413
Gray iron, Canada, 1924	429
Loss in Canada	16

Malleable Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	230
United States and Canada, 1924	229
Increase	1
United States, 1926	214
United States, 1924	209
Increase	5
Canada, 1926	16
Canada, 1924	20
Decrease	4

Steel Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	380
United States and Canada, 1924	374
Increase	6
United States, 1926	357
United States, 1924	347
Increase	10
Canada, 1926	23
Canada, 1924	27
Decrease	4

Electric Steel Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	199
United States and Canada, 1924	191
Increase	8
United States, 1926	182
United States, 1924	174
Increase	8
Canada, 1926	17
Canada, 1924	17
Increase	0

lishments. Few large manufacturing interests, outside the railway, implement and a few of the larger automobile works, operate their own steel or malleable foundries.

A further contributing factor to the casualty list of gray iron shops is the prevalence of numbers of smaller institutions, which in many cases are financed inadequately to resist the frosts of keen competition under declining demand. Much more capital is required to embark upon the manufacture of steel and malleable castings than to erect a small cupola in a converted cannery and start making gray iron jobbing castings for small town trade. The trend seems to be, even in gray iron lines, toward larger units. These small gray iron shops go out of business in periods of depression. Consolidations in some instances have served to remove names

TABLE II

Nonferrous Foundries 1926-1924

Total Exclusive Brass Foundries and Brass Departments of Other Plants in the United States and Canada, 1926-1924

United States and Canada, 1926	3625
United States and Canada, 1924	3574
Increase	51
Total brass, United States, 1926	3316
Total brass, United States, 1924	3265
Increase	51
Total brass, Canada, 1926	309
Total brass, Canada, 1924	309
Increase	0

Exclusive Brass Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	1487
United States and Canada, 1924	1452
Increase	35
Exclusive brass, United States, 1926	1421
Exclusive brass, United States, 1924	1382
Increase	39
Exclusive brass, Canada, 1926	66
Exclusive brass, Canada, 1924	70
Decrease	4

Brass Departments of Gray Iron, Malleable and Steel Foundries in the United States and Canada, 1926-1924

United States and Canada, 1926	2138
United States and Canada, 1924	2122
Increase	16
Brass departments, United States, 1926	1895
Brass departments, United States, 1924	1883
Increase	12
Brass departments, Canada, 1926	243
Brass departments, Canada, 1924	239
Increase	4

Foundries Melting Aluminum in the United States and Canada, 1926-1924

United States and Canada, 1926	2637
United States and Canada, 1924	2586
Increase	51
United States, 1926	2404
United States, 1924	2364
Increase	40
Canada, 1926	233
Canada, 1924	222
Increase	11

STEEL FOUNDRIES IN THE UNITED STATES AND CANADA, AUG. 1, 1926

EXCLUSIVE BRASS FOUNDRIES IN THE UNITED STATES AND CANADA, 1926

TOTAL BRASS FOUNDRIES IN THE UNITED STATES AND CANADA, 1926

TABLE III

FOUNDRIES OF THE UNITED STATES AND CANADA

Listed by States and Provinces, 1926 and 1924

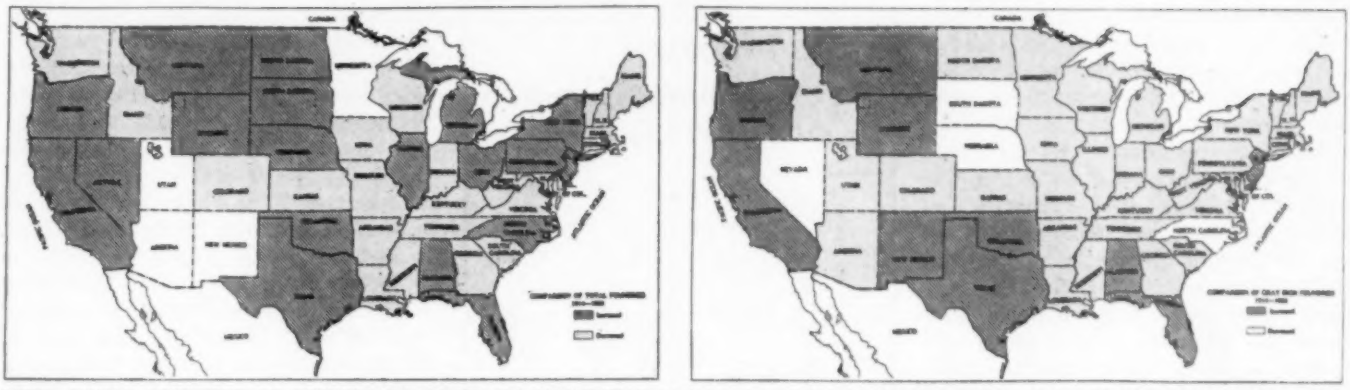
	Total Foundries 1926	Total Foundries 1924	Increase or decrease in two years	Gray iron foundries 1926	Gray iron foundries 1924	Exclusive nonferrous foundries 1926	Exclusive nonferrous foundries 1924	Nonferrous foundries depart. of other shops, 1926	Nonferrous foundries depart. of other shops, 1924	Total nonferrous foundries 1926	Total nonferrous foundries 1924	Malleable iron foundries 1926	Malleable iron foundries 1924	Steel foundries 1926	Steel foundries 1924	Foundries melting aluminum 1926	Foundries melting aluminum 1924	Electric steel foundries 1926	Electric steel foundries 1924
Alabama	97	97	..	90	93	5	4	33	32	38	36	2	1	4	6	26	25	2	4
Alaska	2	2	..	2	2	..	..	1	1	1	1	..	..	1	1	..	..	1	1
Arizona	9	8	+ 1	9	8	..	..	9	8	9	8	1	1	1	1	3	3	1	..
Arkansas	17	18	— 1	17	18	..	..	15	15	15	15	..	..	1	1	9	8	1	1
California	228	217	+11	148	141	62	59	80	78	142	137	4	3	24	21	114	109	18	20
Canal Zone	1	1	..	1	1	..	..	1	1	1	1	..	..	1	1	1	1	..	..
Colorado	42	43	— 1	32	31	10	11	10	11	20	22	..	..	4	4	16	17	2	1
Connecticut	160	147	+13	76	79	73	70	35	39	108	109	13	13	8	7	71	73	2	3
Delaware	16	15	+ 1	9	9	4	4	7	7	11	11	1	1	2	3	4	6	1	..
Dist. of Columbia	9	9	..	6	6	2	3	4	4	6	7	..	..	1	1	6	7	..	..
Florida	24	23	+ 1	22	21	2	2	20	21	22	23	..	1	1	1	20	21	1	1
Georgia	74	73	+ 1	69	65	5	5	47	49	52	54	..	..	1	1	32	37	1	1
Hawaii	2	3	— 1	2	3	..	..	2	2	2	2	..	..	..	..	1	1	..	..
Idaho	9	9	..	9	9	..	..	8	9	8	9	..	..	..	..	7	8	..	..
Illinois	467	490	—23	297	311	140	131	109	118	249	249	28	32	26	25	187	174	13	11
Indiana	229	245	—16	163	175	48	50	59	61	107	111	17	15	12	11	88	88	3	3
Iowa	99	109	—10	85	91	8	12	47	45	55	57	1	1	7	6	39	44	3	3
Kansas	43	49	— 6	39	44	3	4	25	30	28	34	1	2	..	1	25	29	..	1
Kentucky	51	52	— 1	40	41	11	12	21	14	32	26	..	..	..	..	22	16	..	..
Louisiana	31	31	..	25	27	5	3	18	19	23	22	..	..	5	4	11	13	3	3
Maine	30	35	— 5	27	31	3	4	19	23	22	27	..	..	..	..	19	19	..	..
Maryland	60	62	— 2	42	43	18	19	18	19	36	38	2	2	1	1	20	27	..	..
Massachusetts	265	273	— 8	159	166	94	87	57	60	151	147	3	4	14	14	114	114	7	8
Michigan	372	415	—43	229	235	116	112	112	97	228	209	15	14	14	11	158	134	7	6
Minnesota	109	113	— 4	80	89	24	21	44	47	68	68	1	1	7	7	54	55	3	3
Mississippi	21	21	..	21	21	..	..	19	19	19	19	..	..	..	..	10	7	..	..
Missouri	133	131	+ 2	94	90	36	37	33	32	69	69	2	2	8	5	50	52	3	2
Montana	12	13	— 1	12	13	..	..	12	12	12	12	..	..	..	..	9	9	..	..
Nebraska	31	28	+ 3	24	24	6	3	14	18	20	21	..	..	1	1	18	18	1	1
Nevada	5	4	+ 1	4	3	1	1	4	3	5	4	..	..	1	..	4	3	1	..
New Hampshire	32	32	..	27	27	5	5	16	16	21	21	1	1	1	1	15	11	1	1
New Jersey	248	255	— 7	162	158	77	86	67	53	144	139	5	5	8	9	102	100	4	4
New Mexico	3	2	+ 1	3	2	..	..	3	2	3	2	..	..	..	..	2	2	..	..
New York	544	562	—18	363	350	163	153	172	162	335	315	24	23	18	18	235	233	11	9
North Carolina	66	63	+ 3	66	63	..	..	51	48	51	48	..	1	1	1	43	40	..	..
North Dakota	2	2	..	2	2	..	..	1	1	1	1	..	..	..	..	1	1	..	..
Ohio	636	656	—20	386	414	193	186	115	114	308	300	38	31	39	40	220	214	20	20
Oklahoma	35	34	— 1	28	28	6	5	17	14	23	19	..	..	1	2	22	17	1	2
Oregon	53	49	+ 4	45	41	5	6	28	23	33	29	1	..	4	4	30	23	3	3
Pennsylvania	774	781	— 7	560	567	157	156	219	217	376	373	24	26	84	88	257	250	29	26
Rhode Island	48	42	+ 6	22	22	25	18	10	10	35	28	1	1	1	1	27	23	1	1
South Carolina	21	19	+ 2	21	18	..	1	18	15	18	16	..	..	..	..	13	13	..	..
South Dakota	7	8	— 1	6	7	1	1	4	3	5	4	..	..	..	..	4	3	..	..
Tennessee	87	76	+11	77	68	10	6	46	38	56	44	2	1	3	2	37	31	1	..
Texas	82	75	+ 7	67	58	14	15	42	38	56	53	1	..	6	5	39	39	4	3
Utah	18	22	— 4	16	20	2	1	11	15	13	16	..	..	1	1	10	13	1	1
Vermont	23	27	— 4	21	25	2	2	10	11	12	13	..	..	..	..	9	11	..	..
Virginia	74	79	— 5	73	78	..	..	49	54	49	54	1	1	5	4	38	43	4	3
Washington	84	96	—12	62	67	15	19	38	45	53	64	2	1	13	12	43	45	11	10
West Virginia	47	49	— 2	39	39	7	9	24	29	31	38	1	1	6	5	23	26	3	2
Wisconsin	250	277	—27	162	188	63	59	68	78	131	137	22	24	21	21	93	105	14	16
Wyoming	3	3	..	3	3	..	..	3	3	3	3	..	..	..	..	3	2	..	..
Total in U. S.	5785	5945	—160	4044	4135	1421	1382	1895	1883	3316	3265	214	209	357	347	2404	2364	182	174
CANADA																			
Alberta	15	15	..	12	12	3	3	12	12	15	15	1	..	2	..	13	12	..	..
British Columbia	32	33	— 1	27	29	5	4	18	18	23	22	..	..	..	2	16	19	2	2
Manitoba	16	14	+ 2	13	11	2	2	6	5	8	7	..	..	2	2	7	5	2	2
New Brunswick	14	19	— 5	14	15	..	2	12	11	12	13	..	..	..	..	9	8	..	..
Newfoundland	3	2	+ 1	3	2	..	..	2	1	2	1	..	..	..	..	1	1	..	..
Nova Scotia	26	29	— 3	25	27	..	..	20	22	20	22	3	4	1	1	10	12	1	1
Ontario	283	310	—27	235	247	41	44	120	121	161	165	11	13	8	10	119	112	4	5
Prince Edward Is.	3	3	..	3	3	..	..	2	2	2	2	..	..	..	..	1	1	..	..
Quebec	100	102	— 2	78	80	15	15	48	44	63	59	1	3	10	12	54	49	8	7
Saskatchewan	3	3	..	3	3	..	..	3	3	3	3	..	..	..	..	3	3	..	..
Total in Canada	495	530	—35	413	429	66	70	243	239	309	309	16	20	23	27	233	222	17	17
Total in U. S. and Canada	6280	6475	—195	4457	4564	1487	1452	2138	2122	3625	3574	230	229	380	374	2637	2586	199	191

from this year's *Penton's Foundry List.* The uniting of a number of large stove manufacturers is an example of this trend.

Turning to a careful study of the individual summaries, it will be noted that the total number of foundries in the United States and Canada, in 1926 is 6280 compared with 6475, two years ago. In the United States alone, the decrease has been from 5945 in 1924 to 5785, in 1926. In Canada the figures are 530 for 1924 and 495 for 1926.

These totals parallel closely the gray iron summaries, as will be observed from the accompanying table. The total of gray iron foundries on both sides of the border at present is 4457, compared with 4564 two years ago, while for the United States alone the totals are 4044 in 1926 and 4135 in 1924, and in Canada, 413 in 1926 and 429 in 1924, giving a loss of 16.

A remarkable picture of the tendency in recent years among gray iron foundries is found in making a comparison with the compilations of 1914, which may be taken as indicative of the immediate prewar period. At that time the total number of foundries in the United States alone was 5942, while today it is 5785 showing a decrease of 157 shops. Continuing to the gray iron foundries a loss of 530 in the number of plants is en-



LEFT—TOTAL NUMBERS OF FOUNDRIES NOTED IN DIFFERENT STATES IN 1926, COMPARED WITH 1914. RIGHT—COMPARISON OF GRAY IRON FOUNDRY SHOPS IN DIFFERENT STATES IN 1926 AGAINST 1914. THE DIAGONAL SHADING INDICATES AN INCREASE AND THE DOTTED PORTION SHOWS DECREASES

countered, the totals being 4574 in 1914 and 4044 in 1926. All other classifications showed an increase ranging from 18 malleable shops to 554 aluminum foundries. On the face of these returns, is registered the decline toward extinction of gray iron foundries.

However, a further study shows that this assumption is entirely wrong, for today more iron is being melted and cast into gray iron products than ever before. Unfortunately no actual figures of total or average melt are available, but an accurate measure may be had from the production of foundry iron. Although this gives only an indication, since the proportionate amount of various kinds of scrap must vary over a wide range, it is sufficiently accurate for the purposes at hand.

Considering the three year period from 1912 to 1914, inclusive, the output of foundry iron as given by the American Iron & Steel institute averaged 4,942,490 tons per year. Comparing this with the three years immediately preceding the compilation of this list of foundries, an average yearly output of 5,834,421 tons is noted. In other words, in 1926 with 530 less gray iron foundries in operation, than in 1914, the production and, therefore most probably, the consumption of foundry iron has increased almost 900,000 tons or 18 per cent.

The explanation for this apparent paradox may be found in the increase of larger foundries melting greater tonnages, in increased production per man and per unit of equipment and in the consolidation of smaller units and the reduction of idle capacity. Undoubtedly stabilization and a cessation of deflation is at hand.

The changing character of demand for cast products in the past 12 years further is indicated by the two maps reproduced on this page. The states which have shown an increase or decrease in the *total* number of found-

TABLE IV

Roll Call of Foundries by States, 1926-1924

Standing	State	1926	1924	Standing	State	1926	1924
1	Pennsylvania	774	781	27	Kansas	43	49
2	Ohio	636	656	28	Colorado	42	43
3	New York	545	562	29	Oklahoma	35	34
4	Illinois	467	490	30	New Hampshire	32	32
5	Michigan	372	415	31	Louisiana	31	31
6	Massachusetts	265	273	32	Nebraska	31	28
7	Wisconsin	250	277	33	Maine	30	35
8	New Jersey	248	255	34	Florida	24	23
9	Indiana	229	245	35	Vermont	23	27
10	California	228	217	36	Mississippi	21	21
11	Connecticut	160	147	37	South Carolina	21	19
12	Missouri	133	131	38	Utah	18	22
13	Minnesota	109	113	39	Arkansas	17	18
14	Iowa	99	109	40	Delaware	16	15
15	Alabama	98	97	41	Montana	12	13
16	Tennessee	87	76	42	District of Columbia	9	9
17	Washington	84	96	43	Idaho	9	9
18	Texas	82	75	44	Arizona	9	8
19	Virginia	74	79	45	South Dakota	7	8
20	Georgia	74	73	46	Nevada	5	4
21	North Carolina	66	63	47	Wyoming	3	3
22	Maryland	60	62	48	New Mexico	3	2
23	Oregon	53	49	49	Hawaii	2	3
24	Kentucky	51	52	50	Alaska	2	2
25	Rhode Island	48	42	51	North Dakota	2	2
26	West Virginia	47	49	52	Canal Zone	1	1

TABLE V

Leading Foundry Cities of the United States and Canada, 1926-1924

Standing	City	Total Foundries 1926	Total Foundries 1924	Standing	City	Total Foundries 1926	Total Foundries 1924
1	Chicago	204	200	32	Reading, Pa.	27	28
2	Cleveland	125	118	33	Bridgeport, Conn.	27	27
3	New York	111	115	34	Springfield, O.	24	26
4	Detroit	109	109	35	Atlanta, Ga.	23	22
5	Philadelphia	109	109	36	Worcester, Mass.	22	23
6	Los Angeles	76	70	37	Canton, O.	22	22
7	St. Louis	73	68	38	Grand Rapids	22	21
8	Milwaukee	68	74	39	Kansas City	21	24
9	Pittsburgh	67	63	40	Racine, Wis.	21	21
10	Buffalo	65	61	41	Providence, R. I.	20	20
11	Boston (Greater Boston)	64	72	42	Oakland, Calif.	19	21
12	Cincinnati	61	65	43	Vancouver, B. C.	19	19
13	Newark, N. J.	46	50	44	Moline, Ill.	19	15
14	San Francisco	44	42	45	Evansville, Ind.	19	13
15	Toronto, Ont	42	49	46	Jersey City, N. J.	18	20
16	Baltimore	42	40	47	Anniston, Ala.	18	16
17	Minneapolis	40	41	48	Hamilton, Ont.	17	18
18	Toledo, O.	35	36	49	Rockford, Ill.	17	18
19	Columbus, O.	34	37	50	St. Paul, Minn.	17	16
20	Montreal, Que	34	37	51	Kalamazoo, Mich	17	15
21	Erie, Pa.	33	31	52	Lancaster, Pa.	16	17
22	Birmingham, Ala.	30	33	53	Quincy, Ill.	16	17
23	Dayton, O.	30	32	54	Trenton, N. J.	16	16
24	Louisville, Ky.	30	30	55	Akron, O.	15	12
25	Syracuse, N. Y.	30	24	56	Peoria, Ill.	15	12
26	Seattle	29	36	57	Muskegon, Mich.	14	13
27	Rochester, N. Y.	29	27	58	York, Pa.	14	13
28	Indianapolis	28	34	59	New Haven, Conn.	14	16
29	Denver, Colo.	28	29	60	Saginaw, Mich.	13	15
30	Portland, Oreg.	28	28	61	New Britain, Conn.	13	13
31	Chattanooga, Tenn.	28	26	62	West Allis, Wis.	13	11
				63	Richmond, Va.	13	12

ries are shown at the left, while those which have recorded similar changes in gray iron foundries may be noted at the right. These comparisons were made between the 1914 and 1926 editions of Penton's list. All the great producing centers show a loss in the number of gray iron foundries, as might be expected from the summaries previously quoted. However, the various other classifications, notably brass, steel and malleable have made an impression and gains are shown in many states in the totals listed. Pennsylvania, New York, Ohio, California and Michigan have registered decided gains, while the south and southwest have gone forward in the general count and in the number of gray iron shops.

Returning to comparisons drawn between 1924 and 1926, nonferrous foundries show decided increases. The total of brass foundries is 51 higher this year having mounted from 3574 in 1924 to 3625 in 1926, considering both the United States and Canada. All of this gain is in the United States, as the total in Canada remains unchanged.

The malleable foundry industry has been stabilized for a number of years, with the rate of production averaging from 60 to 75 per cent of capacity. However, a slight advance in the number of malleable foundries is noted, the totals in the United States and Canada being 229 for 1924 and 230 for 1926. The United States alone shows a gain of 5 shops, and Canada a loss of 4.

A similar condition is encountered in the steel foundry branch. Here the United States shows a gain of 10 and Canada a decrease of 4, making the net gain 6 units, with totals of 374 for 1924 and 380 in 1926.

An increase in the number of foundries melting steel in electric furnaces is noted. The total for the United States and Canada in 1924 was 191 and this has been advanced to 199, with Canada showing the same number, but a gain of 8 shops indicated in the United States. The gains in electric furnace shops are noted in Colorado, 1 ; Illinois, 2; Michigan, 1; Missouri, 1; New York, 2; Pennsylvania, 3; Texas, 1; Virginia, 1; Washington, 1; and West Virginia, 1. The compensating losses, giving the net gain of 8 will be noted in Table III.

The number of foundries melting aluminum in the United States and Canada increased from 2586 in 1924 to 2637 in 1926, giving a net increase of 51. Of this number the United States shows 40 additional melters of aluminum and Canada has 11 more.

The roll call of foundries by states shows some interesting developments. The order of the first five, Pennsylvania, Ohio, New York, Illinois and Michigan remains unchanged, although a decrease in the total number of foundries in each state is noted. Each state, except New York, shows a decided decline in the number of gray iron foundries. However, the number of steel foundries in Illinois and Michigan increased. The malleable shop in Ohio advanced 7 to a total of 38 and gained one each in New York and Michigan, and the brass and aluminum melting establishments increased in all of the states mentioned, except in Illinois.

Further down the list, the order has changed in many cases, Massachusetts going ahead of Wisconsin for sixth place, Tennessee ranging up the line from eighteenth to sixteenth, Oregon moving up two notches to twenty-third and Rhode Island the tiniest state has moved up from twenty-eighth to twenty-fifth place.

Among the Canadian provinces, Ontario still maintains a decided lead with 283 foundries, 27 less than the total of 310 reported in 1924. Quebec is next with an even 100 against 102, two years ago, and next in order come British Columbia, 32, Nova Scotia, 26, Manitoba, 16, Alberta, 15, and New Brunswick, 14.

A similar relationship among the leading five, is found in the classification of foundries by cities. Chicago still is in the lead with 204 shops, a gain of 4; Cleveland, second with 125, compared with 118 two years ago; New York third, with 111 against a previous 115; Detroit, fourth with the same number, 109 which ties it with Philadelphia both in 1924 and 1926. Los Angeles has moved up from eighth to sixth place, with an increase from 70 to 76 foundries; while Milwaukee, formerly sixth has dropped to eighth with a decline from 74 to 68 active establishments. St. Louis moved up to seventh with an increase from 68 to 73 in the two year period. Pittsburgh comes next to Milwaukee with 67 foundries, compared with 63 in 1924. Buffalo, in tenth place now has 4 additional shops, making a total of 65, while Boston has dropped down the line to eleventh with 64, instead of 72 shops reported in 1924. Moline, Ill. with an increase of 4 shops goes from fifty-third to forty-fourth place. The list of cities, which includes all those having 12 or more foundries now numbers 63 instead of 57.

A similar list of cities compiled from the count of total brass foundries shows Chicago in the lead again with 109 shops, with New York, Detroit, Philadelphia and Cleveland rounding out the first five cities in the production of brass castings. The next five in the order of their importance in casting nonferrous metals are Boston, Los Angeles, Milwaukee, St. Louis and Cincinnati.

TABLE VI

Leading Brass Centers 1926-1924

Standing	City	1926	1924
1	Chicago	109	99
2	New York City	73	78
3	Detroit	70	67
4	Philadelphia	67	72
5	Cleveland	61	60
6	Boston	41	44
7	Los Angeles	39	33
8	Milwaukee	37	41
9	St. Louis	37	34
10	Cincinnati	34	36
11	Pittsburgh	27	28
12	Newark	25	23
13	Buffalo	24	25
14	Montreal, Que.	23	22
15	San Francisco	22	23
16	Minneapolis	21	19
17	Baltimore	21	23
18	Rochester, N. Y.	19	14
19	Toronto	19	24
20	Grand Rapids	17	14
21	Bridgeport, Conn.	17	16
22	Columbus	16	17
23	Toledo	15	15
24	Syracuse, N. Y.	14	13
25	Louisville, Ky.	13	11
26	Providence, R. I.	13	11
27	Vancouver, B. C.	11	10
28	Worcester, Mass.	11	12
29	Trenton, N. J.	11	9
30	Portland, Oreg.	10	8
31	Erie	10	9
32	Lancaster, Pa.	10	11
33	Scranton, Pa.	10	10
34	Spokane	10	11

Heat Sandblast Sand

Question: Why is sandblast sand heated? Does the heating process increase its value in any manner?

Answer: Sand that is employed in sandblast operation is heated simply for the purpose of driving off any moisture. Moisture in sharp sand acts as a bond and prevents it from flowing freely. In the various forms of sandblast devices the sand is conveyed by air at pressures varying from 80 to 100 pounds per square inch and unless it is perfectly dry it will clog the passages. Even if the sand could be used while in a wet condition it would be objectionable on account of the condition in which it would leave the face of the casting.

The Apex Smelting Co., Chicago, is manufacturing a flux for aluminum that was developed by Robert J. Anderson, metallurgical engineer. It is claimed that the action of the flux is partly mechanical and partly chemical and affects a separation of occluded drosses and other suspended matter, producing a metal free from foreign inclusions.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

MASTER SPECIFICATION FOR HEAVY RUST PREVENTIVE COMPOUND

(*Concluded from Data Sheet No. 632*)

(*f*) Adhesion and protection.—Four mechanically polished bright steel plates approximately 4 by 6 inches by 1/8-inch shall be tacked to separate boards and thoroughly cleaned by the use of benzol. The material to be examined shall be heated to 70 degrees Cent. (158 degrees Fahr.) and an excess flowed over the plates. One of the plates shall be kept in a vertical position in the laboratory for 24 hours and then placed in a rack exposed to the weather in an unshaded location, so that the plate shall be inclined to an angle of 45 degrees to the vertical, facing south. The plate shall be sprayed lightly with a 3 per cent salt solution on the first day and left exposed to the weather for not less than 5 nor more than 60 days. The other 3 plates shall be hung in a vertical position in an oven and maintained at a temperature of 45 to 50 degrees Cent. (113 to 122 degrees Fahr.) for at least 48 hours. The plates shall be removed from the oven, allowed to cool, and one plate exposed in the rack described previously. Another plate shall be kept in a horizontal position and lightly sprayed with a 3 per cent solution once every day for a period of 5 days. The fourth plate shall be placed under an intermittent shower, a vigorous shower being applied for approximately 3 to 4 minutes, then no water for about the same length of time. The shower may be formed by allowing water to siphon at intervals from a 5-gallon tank into a metal trough, the bottom of which has three or four parallel rows of small holes about 1/8-inch in diameter. The water should fall about 2 feet from the trough to the plate, which is held in a position about 60 degrees to the vertical immediately under the falling water. At the end of 5 hours of this intermittent showering, the plate shall be placed in a horizontal position and allowed to remain with any adhering water for at least 24 hours. No rust shall be in evidence on any of the 4 plates after the completion of the test and the coating on all the plates shall be easily removed with waste wet with kerosene.

VI. PACKING AND MARKING

No details.

VII. ADDITIONAL INFORMATION

Rust-preventive compounds conforming to this specification are the most satisfactory easily removable materials for the protection of metal. However, owing to its heavy consistency it is sometimes advisable to use more fluid material on bearing surfaces that must be moved from time to time without removing the coating.

Rust-preventive compounds are frequently called *slushing grease* or *slushing oil*, but these terms have no fixed meaning and their use is to be discouraged.

VIII. GENERAL SPECIFICATIONS

No details.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

TENTATIVE SPECIFICATION FOR 88-8-4 SAND CASTINGS

1. (*a*) These specifications cover alloy castings, the alloy being a composition of copper, tin and zinc, known commercially as 88-8-4.

(*b*) The castings are intended for use where an excellent steam metal, withstanding in the cast state hydrostatic pressures satisfactorily, is required, such as in expansion joints, pipe fittings, valves, pumps, pump pistons and in general where good strength and resistance to salt water are required.

I. MANUFACTURE

2. (*a*) The alloy may be made by any approved method.

(*b*) The castings shall be of uniform quality.

II. CHEMICAL PROPERTIES AND TESTS

3. (*a*) The alloy shall conform to the following requirements as to chemical composition:

	Desired	Minimum	Maximum
Copper, per cent	88.00	86.00	89.00
Tin, per cent	8.00	7.50	11.00
Lead, per cent	none	....	0.30
Zinc, per cent	4.00	1.50	4.50
Iron, per cent	none	....	0.10
Nickel, per cent	....	....	0.50
Phosphorus, per cent	....	....	0.05
Aluminum, per cent	none	....	none
Sulphur, per cent	none	....	0.05
Antimony, per cent	none	....	0.25
Total other impurities, per cent	none	....	0.15

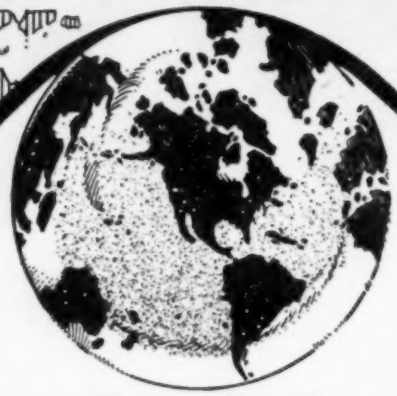
(*b*) Where none is specified it shall be construed to refer to none as determined on a 10-g. sample.

4. (*a*) An analysis of each melt may be made at the option of the purchaser and at his own expense.

(*b*) The sample for chemical analysis shall be taken from cuttings from the test bars.

From the report of committee B-2 on nonferrous metals and alloys presented at the 29th annual meeting of the American Society for Testing materials held at Atlantic City, N. J., June 21-25, 1926.

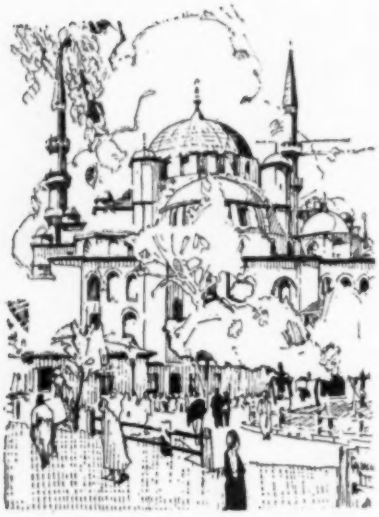
(*Continued on Data Sheet No. 635*)



Around the World with The Foundry

Little Journeys to the homes of our readers

Turkey



WINDS of the desert play today as they have played for centuries over the dusty camel trains laden with corn and wine, many hued rugs, silks and cunning embroidery, and guarded by bands of wild horsemen while on their way to the far-off bazaars of Bagdad, Damascus and Constantinople. Cities that were great and venerable before the Christian Era; cities that loom large in the earliest form of literature; cities that knew Alexander the Great, Ghengis Khan, and Tamerlane, have changed but little in the long centuries that have rolled by since Harun-al-Rashid and his faithful old Grand Vizier Giaffor sought recreation, entertainment and adventure, prowling by night through the smelly streets and crooked byways of old Bagdad, sprawling over a great plain on both sides of the Tigris river.

Jealous, reserved and proud, followers of the Prophet view Occidental people and their methods with disfavor and it is only in recent years that practical demonstrations of Western science and invention have been tolerated in the country. The introduction of a railroad and the establishment of an army and navy on a European basis, created a demand for castings, but up to the present, nearly all are imported. THE FOUNDRY goes into Constantinople twice a month and helps at least one foundryman in his efforts to push back the frontier.

"Wherever metals are cast you'll find THE FOUNDRY"

Improve Gray Iron Properties by Heat Treatment-I

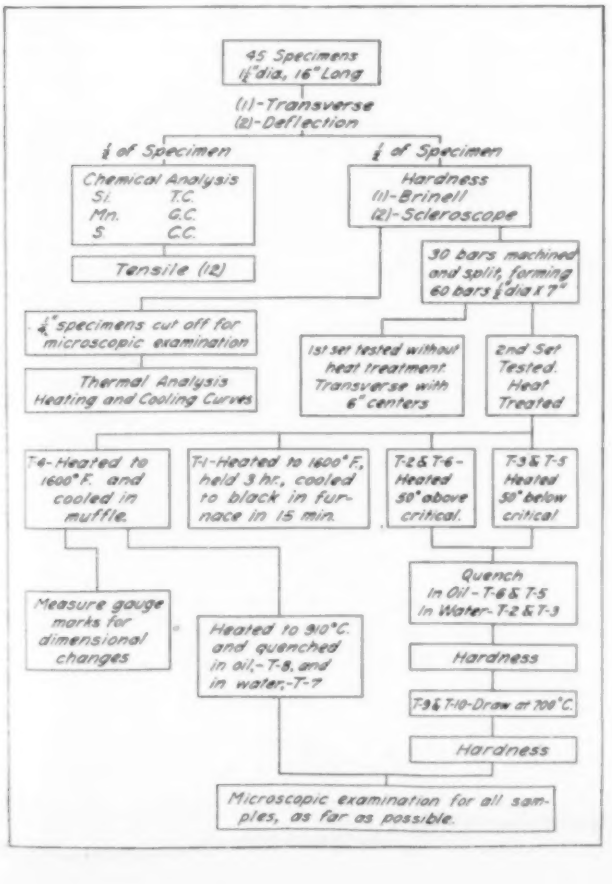
By O. W. Potter

THE complexity of the composition of cast irons (including semisteel) and the difficulty of controlling compositions during melting have no doubt been factors in hindering extensive investigations. The general indifference of the gray iron foundrymen to foster research for the study of ways and means to improve the qualities of cast iron also has been a hindering factor to the study of the effects of heat treatment. It generally has been thought that cast iron, being a weak, brittle material, comparatively cheap in cost of production, could not have its properties improved. The late Doctor Howe, an authority on steels and cast irons, stated many years ago that he believed the possibilities of improving the properties of gray cast iron by heat treatment were even greater than they were for steel. We find today that through stress of production demanding ease of machinability and uniform properties that heat treatment has been resorted to with considerable success.

Gray cast iron has two properties, the control of which always has been one of the foundrymen's big problems. They are the hardness and dimensional changes under repeated heating and cooling. To produce uniform hardness and eliminate massive cementite from gray iron is the constant endeavor of every foundryman manufacturing castings which must be machined. Cementite is extremely hard and soon ruins the best cutting tools. The ideal condition is to have gray cast iron wholly in a pearlitic condition. This is difficult to obtain under ordinary casting conditions because of such influencing factors as casting temperature, rate of cooling, chemical composition carbon content, amount of impurities present, design of casting, etc. It has been found by some manufacturers that the only real satisfactory method of getting uniform hardness and the elimination of massive cementite is to heat treat (anneal) the castings. This low temperature heat treatment or anneal generally is beneficial because the casting strains are relieved; also the machining is made easier owing to the reduction of hardness.

Gives Important Data

HEAT treatment of tools, malleable and steel castings long has been common practice but the application of heat treatment or annealing to cast iron is of comparatively recent origin. The casting stresses that occur in cast iron are relieved by heat treatment, and it has been found that cast iron has benefited in other ways, such as in giving increased elongation, and increased resistance to impact. This article which was abstracted from a paper presented at the American Foundrymen's convention at Syracuse, N. Y., Oct. 5-9, describes the effect of heat treating on gray iron and semisteel and gives the temperatures at which the best results may be obtained. It will be published in three parts of which the accompanying is the first. The author is connected with the University of Minnesota, Minneapolis.


45 Specimens 1¼" dia, 16" Long
(1)-Transverse
(2)-Deflection
¼ of Specimen
¼ of Specimen
Chemical Analysis
Si. T.C.
Mn. G.C.
S C.C.
Hardness
(1)-Brinell
(2)-Scleroscope
Tensile (12)
30 bars machined and split, forming 60 bars ½ dia x 7"
¼" specimens cut off for microscopic examination
Thermal Analysis Heating and Cooling Curves
1st set tested without heat treatment. Transverse with 6" centers
2nd Set Tested. Heat Treated
T-6-Heated to 1600° F. and cooled in muffle.
T-1-Heated to 1600° F, held 3 hr, cooled to black in furnace in 15 min.
T-2 & T-6-Heated 50° above critical.
T-3 & T-5 Heated 50° below critical
Quench In Oil - T-6 & T-5 In Water - T-2 & T-3
Measure gauge marks for dimensional changes
Heated to 910° C. and quenched in oil, - T-8, and in water, - T-7
Hardness
T-9 & T-10-Draw at 700° C.
Hardness
Microscopic examination for all samples, as far as possible.

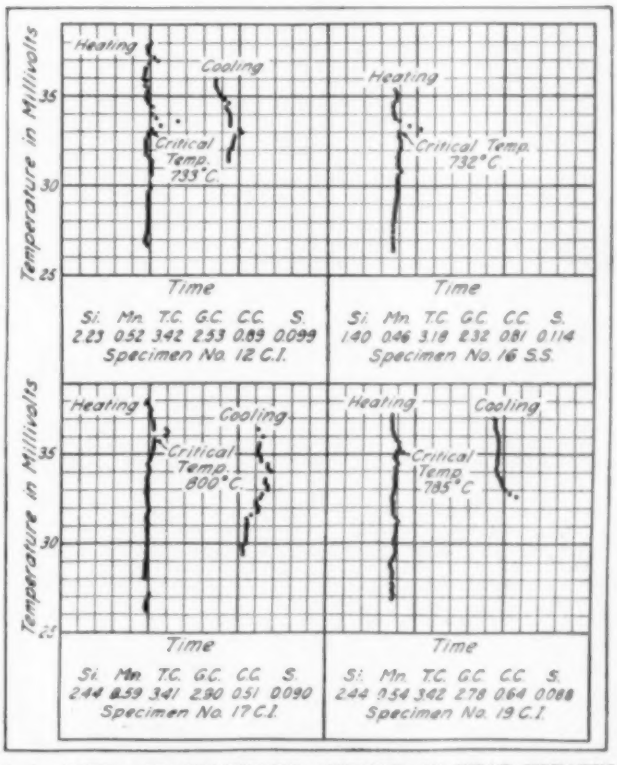


FIG. 1—(LEFT)—DIAGRAMMATIC OUTLINE OF HEAT TREATING TESTS

FIG. 2—(ABOVE)—HEATING AND COOLING CURVES WITH ANALYSIS OF SPECIMENS

TABLE I

Chemical Analysis

Spec. No.	Date Cast	Si.	Mn.	T.C.	G.C.	C.C.	S.
1 C. I.	11-25-24	2.18	.52	3.23	2.58	.65	
2 S. S.	11-25-24	2.09	.58	3.11	2.51	.60	
3 S. S.	11-26-24	1.95	.59	3.03	2.34	.69	
4 C. I.	11-26-24	2.28	.55	3.35	2.77	.58	
5 S. S.	11-28-24	2.02	.54	3.07	2.43	.64	.085
6 C. I.	12- 1-24	2.21	.49				.106
7 S. S.	12- 1-24	2.06	.54	3.28	2.58	.79	.082
8 S. S.	12- 2-24	2.16	.55				.090
9 C. I.	12- 2-24	2.37	.52	3.15	2.75	.40	.092
10 S. S.	12- 3-24	1.87	.53	3.12			.094
11 C. I.	12- 3-24	2.18	.51	3.33	2.53	.80	.101
12 C. I.	12- 4-24	2.23	.52	3.42	2.53	.89	.099
13 S. S.	12- 4-24	1.82	.51	3.20	2.23	.97	.093
14 S. S.	12- 5-24	1.82	.49	3.19	2.28	.91	.092
15 C. I.	12- 5-24	2.11	.48	3.32	2.43	.79	.091
16 S. S. (Cyl.)	12-16-24	1.40	.46	3.18	2.32	.81	.114
17 C. I.	12-12-24	2.44	.59	3.41	2.90	.51	.090
18 S. S.	12-12-24	1.99	.49	3.17	2.26	.91	.050
19 C. I.	12-13-24	2.44	.54	3.42	2.78	.64	.088
20 C. I.	12-15-24	2.25	.54	3.49	2.53	.96	.091
21 S. S.	12-15-24	1.95	.52	3.19	2.20	.99	.094
22 S. S.	12-16-24	1.85	.46	3.10	2.12	.98	.085
23 C. I.	12-16-24	2.09	.52	3.38	2.51	.87	.100
24 S. S.	12-17-24	1.78	.55	3.04			.088
25 C. I.	12-17-24	2.16	.55	3.23	2.30	.93	.108
26 C. I.	12-18-24	2.09		3.23	2.51	.74	
27 S. S.	12-18-24	1.92	.49	3.05			.080
28 C. I.	12-19-24	2.11	.46	3.15	2.57	.58	.105
29 S. S.	12-19-24	1.92	.55	2.50			.100
30 C. I.	12-20-24	2.16	.54	3.23	2.57	.66	.114
31 S. S.	12-20-24	1.87	.52	3.23	2.43	.81	.097
32 S. S. (Cyl.)	12-20-24	1.40	.46	3.22	2.53	.69	.096
33 S. S.	12-22-24	1.92	.53	3.22	2.87	.46	.071
34 C. I.	12-22-24	1.99	.55	3.44	2.66	.78	.098
35 C. I.	12-23-24	2.11	.58	3.41	2.39	1.02	.107
36 S. S.	12-23-24	1.82	.66	3.22	2.47	.75	.088
38 S. S. (Cyl.)	11-29-24	1.97	.49	3.15	2.44	.71	.089
44 C. I.	11-28-24	2.58	.51	3.46	2.84	.62	.081
45 C. I.	11-29-24	2.51	.52	3.42	2.70	.72	.106

TABLE II

Carbon Content

	Untreated			Heat Treated T-1. Heat to 870° C. Cooled Rapidly			T-3. Heat to 735° C. Quenchh in Water		
Spec. No.	T. C.	G. C.	C. C.	T. C.	G. C.	C. C.	T. C.	G. C.	C. C.
17 C. I.	3.41	2.90	.51	3.36	3.03	.33			
20 C. I.	3.49	2.53	.96	3.24	2.95	.29			
33 S. S.	3.22	2.87	.46		3.02				
40				3.14	3.27				
42 S. S.				3.08	2.92	.16			
43 S. S.							2.61	1.98	.63
44 C. I.							2.77	2.66	.11

	Untreated			T-4. Heat to 870° C. Cool in Furnace.			T-5. Heat to 735° C. Quench in Oil		
Spec. No.	T. C.	G. C.	C. C.	T. C.	G. C.	T. C.	T. C.	G. C.	C. C.
9 C. I.	2.15	2.75	.40	3.24	3.36	0.0			
12 C. I.	3.42	2.53	.89	3.04	3.16	0.0			
15 C. I.	3.32	2.43	.89	3.36	3.46	0.0			
21 S. S.	3.19	2.20	.99	3.06	3.10	0.0			
28 C. I.	3.15	2.57	.58	3.06	3.24	0.0			
31 S. S.	3.23	2.43	.81	3.38	3.42	0.0			
(38) 41 S. S.	3.15	2.44	.71	3.10	3.02	0.0			
42 S. S.				3.04	2.90	0.0			
45 C. I.	3.42	2.70	.72	3.14	3.34	0.0			
11 C. I.	3.33	2.53	.80				3.12	2.80	.32
35 C. I.	3.41	2.39	1.02				2.76	2.76	0.0

TABLE III

Table of Critical Temperatures

Authority:	Piwowarsky	Wust and Peterson	W. R. Bean
Analysis:		Chemical Analysis	
Si	2.95	2.25 1.14	.87
Mn.	.63	.60	
P.	.102	.050	
S.	.086	.055	
T. C.	3.18	2.48 3.96	2.58
G. C.	2.49		
C. C.	.69		
Critical Points:		Critical Temperatures	
Ac °C	810–825	800–805	763
°F	1450–1517	1472–1481	1405
Ar °C	725–750	735–740 740–750	746
°F	1357–1382	1355–1364 1364–1382	1375
		Calculated Critical Temperatures	
Ac_2 °C	732	739 713	737
°F	1350	1362 1315	1359

Authority	Forsyth			O. W. Potter			
				Chemical Analysis			
				No. 12	No. 16	No. 17	No. 19
Si	2.28	2.25	2.11	2.23	1.40	2.44	2.44
Mn.	.52	.46	.55	.52	.46	.59	.54
P.	.624	.43	.392				
S.	.035	.09	.079	.099	.114	.09	.088
T. C.	3.19	3.19	3.25	3.42	3.18	3.41	3.42
G. C.	2.96	2.68	2.34	2.53	2.32	2.90	2.78
C. C.	.21	.51	.71	.89	.81	.51	.64
Critical Points:						Critical Temperatures	
Ac °C	765–790	796–804	791–795	732	732	800	785
°F	1409–1454	1465–1479	1456–1463	1350	1350	1472	1445
Ar °C	740–750	751–755	746–755				
°F	1364–1382	1384–1391	1375–1391				
				Calculated Critical Temperatures			
Ac_2 °C	706	735	735	670	693	732	717
°F	1313	1351	1351	1238	1279	1349	1323

Authority:	Hupmobile Co.	Arrow Head Steel Products Co.	Schaap	Harper	H. E. Diller	Dr. E. Schuz
Commercial Heat Treating Temperatures:						
°C	715	830	870	650–760	550–800	700–800
°F	1325	1525	1600	1200–1400	1025–1472	1292–1472

Authority:	Hatfield	Studebaker Corp.
Commercial Heat Treating Temperatures:		
°C	900	760–815
°F	1652	1400–1500

For many years the peculiar growth property of gray cast iron has been known. Outerbridge[1] did some extensive work in the nineties on this property and it has been observed since by many others. In 1924 Bradley Stoughton[2] reported the results of the Schaap process of heat treatment. One of the important findings reported was the elimination of growth under proper heat treatment. If this is correct, then many problems of the manufacture of castings which must be machined and subjected to high temperatures either continuously or intermittently will be lessened. Also the warpage due to casting strains is considerable in cast irons. The ageing of castings has been practiced for many years by some manufacturers to overcome this difficulty, but recent practice is to heat with a low temperature anneal.

Additional data on the effects of heat treatment has been reported by Harper, Piwowarsky, Knowlton, Forsyth, and others, and it is the object of this paper to add further data to this important field.

The material used in this investigation was regular run cast gray iron and semisteel used in a commercial plant. The charges consisted of 50 per cent Northern pig iron and 50 per cent machinery scrap iron melted with a good grade of foundry coke. The semi-steel bars were made from the same materials with 15 to 25 per cent steel added to the charge.

The ordinary arbitration test bar 1¼-inch diameter and 15 inches long, cast according to the recommendations

1—*Journal Iron and Steel Institute*, Vol. 83, No. 1, p. 643.
2—*Iron Age*, Jan. 3, 1924.

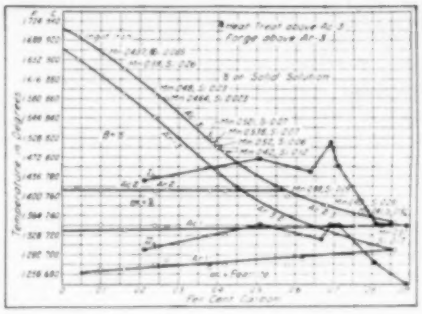


FIG. 3—CRITICAL TEMPERATURES PLOTTED AGAINST COMBINED CARBON CONTENTS

of the American Foundrymen's association, was used. These bars were tested for transverse strength between 12 inch supports with the load at the middle.

An outline of the tests on the sections of the broken bar is shown in diagramatic form in Fig. 1, and a list of specimens and their numbers, dates cast, description and chemical analyses is given in Table 1.

Discussion of Carbon

Comparison of Carbon Content of Gray Cast Iron and Semisteel: Upon examining the chemical analysis of the specimens one of the first noticeable tendencies is the fact that practically every day's run shows a lower total carbon content in the semisteel than in the gray iron. This confirms definitely the opinion of many investigators that properly made semisteel has the lower total carbon content. Whether the combined or graphitic carbon is reduced does not show up so clearly, and no definite tendency seems to be apparent. Analyses of 15 samples of semisteel give an average of 0.78 per cent combined carbon while for 18 samples of gray iron the average was 0.73 per cent.

TABLE IV

Transverse Tests

Specimen No.	Strength (Traverse) Pounds	Physical Properties Def.
1 C. I.	3400	.16
2 S. S.	4450	.18
3 S. S.	5000	.20
4 C. I.	3500	.17
5 S. S.	4350	.16
6 C. I.	3600	.17
7 S. S.	4300	.16
8 S. S.	4300	.18
9 C. I.	3600	.17
10 S. S.	4900	.17
11 C. I.	3400	.16
12 C. I.	4450	.17
13 S. S.	3250	.15
14 S. S.	4700	.18
15 C. I.	3400	.15
16 S. S. (Cyl.)	4400	.20
17 C. I.	3750	.17
18 S. S.	4700	.17
19 C. I.	3700	.18
20 C. I.	3400	.17
21 S. S.	4600	.18
22 S. S.	4650	.18
23 C. I.	3800	.20
24 S. S.	4750	.19
25 C. I.	3800	.19
26 C. I.	3700	.18
27 S. S.	4500	.17
28 C. I.	3400	.15
29 S. S.	4850	.20
30 C. I.	3600	.16
31 S. S.	4850	.20
32 S. S.	4450	.18
33 S. S.	4700	.18
34 C. I.	3750	.16
35 C. I.	3800	.18
36 S. S.	4600	.18
37		
38 S. S. (Cyl.)	4300	.17
41 S. S.	4300	.17
42 S. S.		
44 C. I.	3500	.16
45 C. I.		

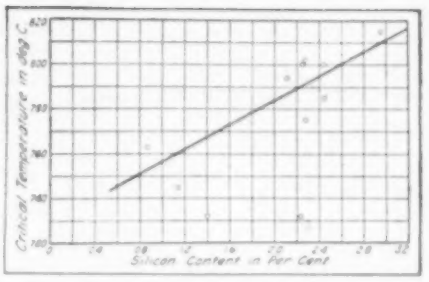


FIG. 4—CRITICAL TEMPERATURE INCREASES WITH ADVANCING SILICON CONTENT

Influence of Heat Treatment on Carbon: The results of the analyses of the specimens for total, combined, and graphitic carbon after heat treatment are shown in Table 2. A study of these results shows the following tendencies:

When heated above the critical point and cooled rapidly (not quenched), as in heat treatment T-1, there is practically no change in total carbon, but the combined carbon has been greatly reduced.

When heated above the critical point and cooled slowly in the furnace (T-4) there seems to be no change in total carbon with the possible exception of extremely high silicon irons, but the combined carbon has been completely decomposed.

Under heat treatment T-3 where the specimens were quenched in water from just below the critical point there was a decided tendency to oxidize some of the carbon.

Under heat treatment T-5 where the specimens were quenched in oil from

TABLE V

Transverse Tests on Small Diameter Bars

Spec. No.	Dia. (d) Inches	Length of Span Inches	Load Pounds	Deflection Inches
11 C. I.	.497	6	440	.06
15 C. I.	.478	6	535	.07
16	.503	6	473	.07
16 S. S. (Cyl.)	.476	6	330 (Flaw)	.05
17 C. I.	.505	6	502	.07
20	.510	6	520	.085
20 C. I.	.491	6	286	.10
21 S. S.	.510	6	660	.06
22 S. S.	.499	5	550	.12
23 C. I.	.502	6	513	.08
24 S. S.	.500	6	638	.07
25 C. I.	.498	5	660	.02
26 C. I.	.461	6	423	.10
28 C. I.	.407	6	187	.04 (Flaw)
30 C. I.	.503	6	539	.07
31 S. S.	.426	6	273	.03 (Flaw)
32 S. S. (Cyl.)	.498	6	594	.07
33 S. S.	.495	6	543	.065
34 C. I.	.486	5	522	.04
35 C. I.	.488	6	484	.06
40	.497	6	484	.08
41 S. S. (Cyl.)	.500	6	598	.07
43	.500	6	539	.07
44 C. I.	.507	6	520	.06
46 S. S.	.501	6	640	.06
Heated to 1370° F. (735° C.) (T-3). Quenched in cold water.				
43	.492	6	561	.085
44 C. I.	.478	6	441	.095
Quenched in oil. (T-5)				
11 C. I.	.500	6	392	.05
46 S. S.	.496	6	518	.035

Heated to 1600° F. (870° C.) and held for 3 hours. (T-1). Cooled rapidly to black in furnace.				
Spec. No.	Dia. (d) Inches	Length of Span Inches	Load Pounds	Deflection Inches
15 C. I.	.497	6	447	.08
17 C. I.	.512	6	419	.05
19 C. I.	.429	6	397	.07
20 C. I.	.502	6	348	.08
25 C. I.	.498	6	430	.09
33 S. S.	.493	6	342	.085
40	.480	6	370	.09
42 S. S.	.500	5	634	.04
Heated to 1450° F. (790° C.) Quenched in cold water. (T-2).				
23 C. I.	.506	6	527	.06
34 C. I.	.501	5	650	.02
Quenched in oil. (T-6).				
16 S. S.	.498	6	440	.08
36 S. S.	.493	6	584	.09
Heated to 1600° F. (870° C.) and cooled in furnace. (T-4).				
21 S. S.	.410	6	127	.08
26 C. I.	.454	6	308	.09
27 S. S.	.436	6	317	.12
28 C. I.	.404	6	198	.10
30 C. I.	.492	6	450	.09
31 S. S.	.429	6	220	.09
41 S. S.	.502	6	485	.08

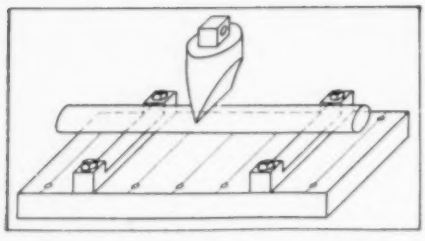


FIG. 5—SPECIAL APPARATUS USED WITH WIRE TESTING MACHINE TO OBTAIN TRANSVERSE STRENGTH

just below the critical point there was also a tendency to oxidize some of the carbon. In addition the amount of combined carbon content was reduced.

Because of the hardness of the specimens quenched in both water and oil from above the critical point (T-2 and T-6) no drillings were obtained and therefore no carbons were determined. The microstructures and hardness of these specimens clearly show a decided increase in the combined carbon content. Lack of time prevented carbon determinations after heat treatments T-7, T-8, T-9, and T-10.

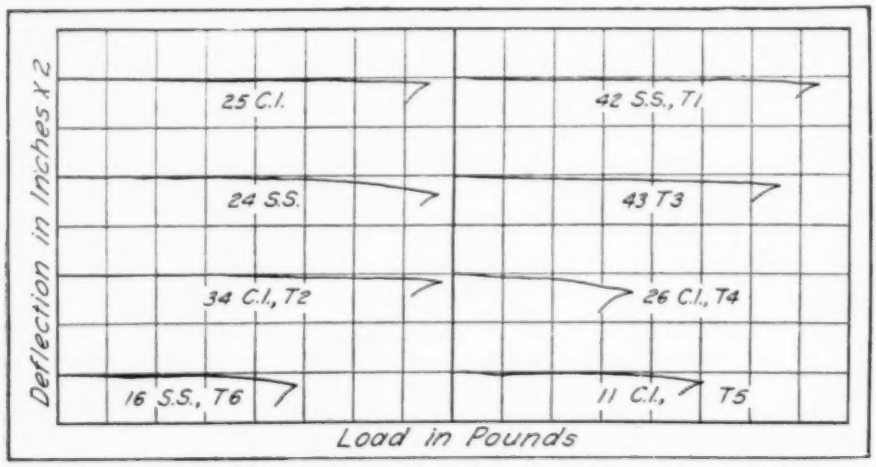


FIG. 6—TRANSVERSE DEFLECTION CURVES OBTAINED BY USE OF SPECIAL DEVICE IN THE WIRE TESTING MACHINE

Determine Thermal Analysis

Thermal analyses were run on four samples of widely varying chemical compositions to determine the critical points. Values were recorded for the inverse rate type of curve, that is, time was recorded for equal advances in temperature (dt/dO). An electric furnace with noble metal heating element and a Leeds-Northrup potentiometer with a galvanometer indicator was used. The analyses of specimens and graphs are as shown in Fig. 2.

The Ac point seemed to show up quite distinctly but the Ar point was rather indeterminate. Since Nos. 17 and 19 were exceptionally high in silicon for heat treatment the average of the results of specimens Nos. 12 and 16 or 735 degrees Cent. was considered to be the critical point for most of the specimens under consideration in this investigation of heat treatment.

According to all the data available the lower critical always occurs above 700 degrees Cent. From those data giving combined carbon analyses the critical point seems to follow somewhat that of steel of the same carbon content as combined carbon in the gray iron. The effect of silicon in steel according to Hoyt and others is to eliminate the Ac^1 and Ac^2 and to raise the Ac^3 points. According to Vigorous[3] the addition of silicon to steel up to 3 per cent has the effect of raising the Ac^2 point 28 degrees Cent. per 1 per cent silicon. Manganese has the opposite effect to silicon and tends to lower the critical at the rate of about 25 degrees Cent. per 1 per cent manganese. Calculating the Ac^2 point on this basis we get the values listed in Table 3. These calculated values check very well and lead one to believe the critical temperature for cast iron may be calculated roughly from the combined carbon, silicon, and manganese contents.

3—*Ibid*, 1913. Vol. 156, p. 1374.

As a matter of comparison a number of commercial heat treating temperatures are given at the end of this table. It is impossible to say from the data available whether or not these heat treating temperatures were selected as a result of thermal analysis. However, it is known that in the case of some companies a thermal analysis by such a method as the *hump* process is used to determine the proper annealing temperature.

In order to show more clearly the relation of the observed critical temperatures and the critical temperatures as calculated from the chemical compositions the results have been plotted in Fig. 3 in which the critical temperatures are plotted against the combined carbon contents. Curve I represents observed values and curve II the calculated values. It will be noted that the observed values are somewhat above Ac^2 while the calculated values fall more nearly on the Ac^1 line and an approximate figure may be set at 730 degrees Cent.

Since the manganese content usually is low and rather constant, this suggests the possibility of the criticai temperature being largely a function of the silicon content. The graph of Fig. 4 was plotted, silicon content against critical temperatures and discarding the two results on the 730 line the points show this tendency. It is the opinion of the author that a definite critical temperature line could be determined on this basis with careful experimental work. Considering

TABLE VI

Effect of Heat Treatment on Test Bars

Spec. No.	Untreated Tr.S	Def.	T-1 Tr.S	Def.	T-2 Tr.S	Def.	T-3 Tr.S	Def.	T-4 Tr.S	Def.	T-5 Tr.S	Def.	T-6 Tr.S	Def.
11 C. I.	440	.06									392	.05		
15 C. I.	535	.07	447	.08										
16 S. S.	473	.07											440	.08
17 C. I.	502	.07	419	.05										
19 C. I.			397	.07										
20 C. I.	520	.085	348	.08										
21 S. S.	660	.06							127	.08				
23 C. I.	513	.08			527	.06								
25 C. I.	660	.02	430	.09										
26 C. I.	423	.10							308	.09				
27 S. S.									317	.09				
28 C. I.	187	.04							198	.10				
30 C. I.	539	.07							430	.09				
31 S. S.	273	.09							220	.09				
33 S. S.	543	0.65	342	.085										
34 C. I.	522	.04			650	.02								
36 S. S.													584	.09
40	484	.08	370	.09										
41 S. S.	598	.07							485	.08				
42 S. S.				.04*										
43	539	.07					561	.085						
44 C. I.	520	.06					441	.095						
46 S. S.	640	.06									518	.035		

(Abreviations).
Tr. S.—Transverse Strength in lbs. of ½" bars on 6" centers.
Def.—Deflection in inches.
*5" centers.

that the points plotted were the results of five different investigations,, which no doubt were conducted under varying conditions, this conclusion looks more convincing.

Table IV gives the results of the transverse tests of the large bars (1¼ inches by 15 inches) and Table V gives the results on the small bars (½ inch by 7 inches). The large bars were tested between 12-inch supports and the small bars between 6-inch supports except where noted otherwise. The special transverse testing apparatus shown in Fig. 5 was used for the small bars with a wire testing machine developed by A. J. Amsler & Co. The machine was equipped with an automatic deflection recording apparatus and deflection curves as shown in Fig. 6 were obtained on all transverse tests made on the small bars.

From the inspection of these curves it can be seen that stress is not directly proportional to strain and therefore the elastic limit is a very low value.

Effect of Heat Treatment

From a comparison of the data given in Table VI the results clearly indicate that the transverse strength is reduced, the longer the time of anneal above the critical. An increase in deflection also followed as would be expected.

Heat treatment T-1 (heating above critical and cooling rapidly) seemed to produce more uniform results than any of the others. When quenched in water from above the critical (T-2) there was a decided increase in transverse strength and a reduction in deflection. The results of the oil quench (T-6) were rather unsatisfactory and no definite conclusions can be drawn. The effect of the transverse strength when the specimens were quenched in water from below the critical (T-3) is not conclusively apparent from these results. The increase in deflection is marked. The oil quench from below the critical (T-5) shows a decrease in both transverse strength and deflection.

These results along with the hardness records seem to affirm the records of Forsyth[4] and Harper[5] in that there is a zone just below the critical where quenching increases the amount of graphitic carbon and thus reduces its strength and hardness. Just what causes the reduction in deflection of the oil quenched specimens is not known.

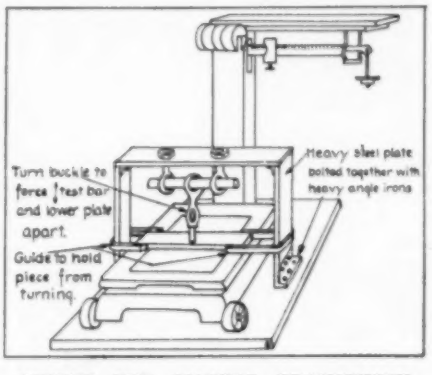
4—A. C. Forsyth, 1924, Met. Thesis, University of Minnesota.

5—Vol. 30, *Transactions American Foundrymen's Association.*

Device To Run Tests

Question—We have an order that specifies the transverse strength on test bars 1¼-inch round and 15 inches long. Could you give us some information on an inexpensive rig to make the few tests that we will have to make?

Answer—The accompanying sketch roughly shows a device that can be used to determine the transverse breaking load. The mounting device


Turn buckle to force test bar and lower plate apart.
Guide to hold piece from turning.
Heavy steel plate bolted together with heavy angle irons

DEVICE FOR MAKING TRANSVERSE TESTS ON SCALE

may be made of heavy steel or of cast iron. It will have to be thick enough to withstand 3500 to 4000 pounds per square inch pressure. It may be made of heavy timber, the horizontal top piece about 5 inches thick. This piece has to be heavier because of the transverse load. The side pieces, due to the load being in tension, need not be as heavy.

The apparatus is mounted and firmly bolted to the platform base with angle irons or heavy brackets. In this way the scale may be removed and used for other purposes. The action of the turnbuckle is such that the pressure forces up on the test bar and down on the platform.

Stopper Rod Bolt Is Burned in Ladle

Question: We have been using a 6-ton bottom pour steel ladle for several years and on an average pour 50 flasks to a heat. We never experienced any trouble until recently when the bolt holding the stopper to the stopper rod began to melt. On several occasions it melted right off so that the rod pulled away and left the stopper head in the nozzle. We naturally assumed that the metal had leaked through the sleeve but an examination afterward disclosed that the sleeve and stopper were in good condition but the bolt was almost melted in two. Are the bolts made of any special steel? We shall appreciate any information you can give us tending to a solution of this apparent mystery.

Answer: It is possible of course that some unusual factor is responsible for the fact that the bolt melts off and leaves the stopper head in the nozzle, but we are inclined to the opinion that it is due to a fairly common cause: Carlessness or ignorance on the part of the man who makes the stopper. The ordinary stopper is made of a graphite plug attached to a steel rod by a bolt and key wedge. The steel rod is protected from the metal in the ladle by a casing made of a number of sleeve bricks provided with male and female joints. The stopper bolt provided with a head at one end and a slot near the other end extends through the graphite stopper and up into a suitable opening in the lower end of the stopper rod also containing a slot corresponding to the slot in the bolt. In making up the stopper rod the man runs the bolt through the stopper into the end of the rod and fastens it there by a steel wedge key. The sleeve bricks then are adjusted by placing a little slurry on each joint and bringing the male and female joints together. A nut on the threaded end of the stopper rod serves to tighten the assembly. After the assembled stopper is complete the man fills the recess in the stopper head surrounding the bolt head. This is the critical feature in all stoppers and the one that usually causes all trouble connected with the stopper head separating from the rod. Sometimes the man forgets to fill this opening with a suitable refractory compound and at other times he does not fill it properly and the result is that the *plug* falls out after the stopper is dried and before it is placed in service in the ladle. Stoppers usually are dried in a vertical position and therefore unless one deliberately examines the bottom of the stopper the absence of the plug will not be noticed. The stopper will close the nozzle opening, but immediately after it is raised to pour the first mold the steel attacks the bolt head and melts it off in a short time.

Will Present Papers

Two papers on the testing of cast iron will be presented at the Detroit meeting of the American Foundrymen's association. One of the papers will be that by George K. Elliott, Lunkenheimer Co., Cincinnati, and the other by Willard Rather, Buffalo Foundry & Machine Co., Buffalo, will deal with some other phases of testing cast iron.

Produce Cores By Thousands With Watch-Making Accuracy

By Pat Dwyer

FIG. 1—RACKS ARE LOADED WITH THE GREEN CORES IN A WIDE GANGWAY

COREMAKING facilities and equipment beyond normal requirements had been installed in the Central Foundry of the Saginaw Products Co., Saginaw, Mich., therefore pace easily was kept with the other departments as the output of castings gradually was pushed up month by month during the past year. The only changes necessary were to increase the number of employes and operate the ovens on a closer schedule. Starting with a daily heat of 200 tons of iron the amount was advanced steadily to 300, 400, then 500 and finally to the ultimate objective of 600 tons. At the 400-ton mark it was found necessary to put on a small night force in the coreroom. At the 500-ton mark this force had to be increased. To meet the 600-ton production schedule the entire battery of 64 ovens must be operated continuously day and night. The night force in the coreroom almost equals the day force. An additional room 30 x 40 feet at the west end of the main coreroom has been fitted up as an assembling department where a number of girls make and finish port cores. A former court, 40 x 360 feet, between the coreroom and the foundry has been roofed over principally with glass and converted into a workshop for the manufacture of cylinder body cores.

Cores enter so extensively into the production of automotive castings that it is not surprising to find the core making department occupies almost as much space as the foundry. The plant was designed by Frank D. Chase Inc., Chicago and the core ovens were built by Holcroft & Co., Detroit. Original plans provided for an installation of 64 ovens, but only one-half the number were installed and used for several years. The remaining units of the battery were erected and placed in commission as rapidly as possible when the proposed output of 600 tons a day was decided upon some time ago.

The ovens, 6½ x 7 x 12 feet, are arranged in two main groups of 32. Each group contains two lines of 16 each, built back to back. They occupy a space approximately in the center of the building with ample room between the line of oven doors and the wall, for the operation of a number of electrically operated trucks engaged in carrying the loaded core racks into and out of the ovens. A similar space separates the two lines of doors on the two inside batteries of ovens which face each other. The entire floor of the coreroom including the wide area surrounding the core oven section is surfaced smoothly with cement to facilitate the operation of the trucks. All the cores are made of sharp sand. Therefore, it is essential that they shall be moved gently from place to place particularly while in a green state.

Expert Drivers

Intelligent young men drive these trucks at breakneck speed and evince a degree of skill that only is paralleled by taxi drivers, aviators who loop the loop and daring young limbs who cheerfully throw themselves in the way of a sudden and violent

death while piloting a roaring racing car around a speedway. The same measure of material reward or of public acclamation may be missing in the foundry, but that is only an inconsequential detail. The basic impulse is the same in all cases and the joy of achievement may be felt as keenly by a man who weaves a tortuous passage through a congested coreroom with a load of fragile cores, as it is by a man who pilots a quivering cyclone on four wheels across the finish line in advance of the field.

At one time it was customary to place the green cores in cold ovens, gradually to raise the temperature to approximately 400 degrees Fahr., hold it thus for an hour and then allow the oven to cool gradually until morning when the cores would be withdrawn and either placed in temporary storage or taken directly to the molding floors. Insistent demand for peak core production has rendered this method obsolete. The ovens are maintained at maximum temperature all the time and the cores are run in and whipped out again in periods ranging from 1 to 3 hours depending on their shape and thickness.

Batteries of ovens are fired with coke from both ends, in a basement which extends under the entire center of the coreroom. Each firing chamber is connected to a single flue that extends under a group of eight ovens and terminates in a stack projecting through the roof. Two openings from the flue through the floor of each oven are controlled by dampers operated from chains on the outside. Two outlets for the gas and steam are provided in the side walls, one near the top and the other below the floor level. These openings also are fitted with slides operated from the outside. A pyrometer is attached to each oven to keep a record of heat fluctuations, but under present high speed production conditions where the ovens practically are forced to capacity, the records are more a matter of form than something of practical use. The ovens never are open more than a fraction of a minute at a time either for depositing loaded racks of green cores, or snatching out the racks of dried cores. Manifestly, the temperature does not drop far in one of these brief periods.

Forced Draft

A long concrete incline on the outside of the south side of the building extends from the coke storage at the east end of the building to a door leading into the basement under the coreroom. Coke for the oven fires is taken down in wheelbarrows and the ashes are removed over the same route. The substructure and firing chambers of the ovens extend to the floor of the basement, but a wide tunnel offers the fireman plenty of room to work at both ends where the fire doors are situated. Lateral tunnels extending east and west connect the firing tunnels and the four form a continuous passageway around the four sides of the area occupied by the oven foundations.

FIG. 2—MANY WOMEN AND GIRLS ARE EMPLOYED IN THE CORE ASSEMBLY DEPARTMENT

It is claimed that the firing pit, flues and draft facilities are so efficient no more coke is consumed in firing a battery of 8 ovens than is consumed in firing only a single oven where careless and inefficient construction and methods obtain. Both forced and induced draft are available if necessary. The basement is equipped with air tight doors. Under certain conditions which prevailed formerly to a greater extent than at present, these doors may be closed and the air pressure raised by a fan on the same principle as that practiced in the fire room of a battleship.

A fan attached to a 15-horsepower motor on the oven roof provides an induced draft on each pair of 8-oven batteries. Among the many minor and major kinks incorporated in the core oven construction are a pair of cams on each post beside the oven door. With these cams in the up position, the door has plenty of latitude in the guides and will not jam in its movement up or down. When the handles of the cams are pulled down they force the edges of the door tightly against the guides thus insuring a close fit and preventing any of the heat from escaping. Core oil is stored in two large tanks in a small building outside the south wall of the building and is pumped into the core mixing stations as required.

Sand Mixing Equipment

Core sand from the storage bins described in the first article of this series is loaded as required into three hoppers built against the outside east end wall of the core department. The

FIG. 3—ROLLER CONVEYORS FACILITATE THE WORK OF ASSEMBLING IN MANY SECTIONS

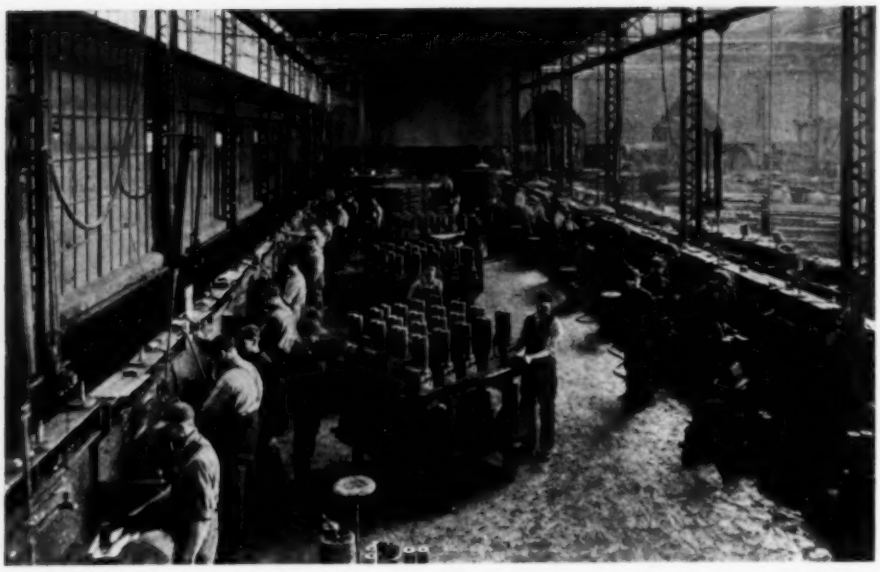


FIG. 4—COMBINED BARREL AND CRANKCASE CORES ARE LOADED ON SKIDS FOR TRANSPORTATION

lower end of the hoppers terminates in an opening on the inside wall. Core sand is prepared according to two standard formulas. One contains 100 parts lake sand, 100 parts bank sand, 3 parts oil and 3 parts of a dry proprietary binder. The second mixture is made up of lake sand exclusively bonded with oil in the proportion of 1 part of oil to 55 parts sand.

The first mixture is used for the body cores in the cylinders, cores which form the inside of the crankcase and the interior of the barrels. The bank sand is added to the mixture to form a green bond that enables the cores to stand up while drying. In several of the illustrations it may be noted that the green core is turned out on a plate with the crankcase part resting on the plate and with the barrels standing up vertically in the air. A short piece of 1-inch pipe pierced with many vent holes serves as a supporting arbor in each barrel.

Sand for water jacket cores is prepared in a milling machine made by the National Engineering Co., Chicago and set up near one of the sand bins at the end of the building. All the cores broken or otherwise spoiled in the core department are thrown into the mill where they are ground fine and incorporated with the core sand mixture. Up to the present as stated previously, no attempt has been made to reclaim any of the core sand that has passed through the foundry. One reason is that more pressing phases of the general problem of tripling the production have monopolized attention. The second reason is that in this district core sand is cheap and plentiful. Eventually, perhaps when the big job is finished and the management has the time and the opportunity to consider minor economies, the general question of sand reclamation will be investigated. In the meantime approximately 200 tons of new core sand is taken in at the east end of the plant and a similar amount of used sand discharged from the west end daily.

All the remaining sand required in the core department is prepared in three paddle type mixers made by the Standard Sand & Machine Co., Cleveland. They are erected close to the east end of the building, immediately in front of the sand supply hoppers and in line with the pan mixer. In other words all the core sand is prepared close to the east end of the core making department. It is distributed by electric truck and wheelbarrow to the various coremaking stations.

Self Loading Machines

A measured amount of sand in a trough in the floor is lifted by a bucket elevator and discharged through a revolving screen into a long pan containing a number of rapidly revolving paddles which effect a thorough blending of the sand by throwing it around and from end to end of the pan. A definite quantity of core oil, 1 part oil to 55 parts sand, is measured out and sprayed over each batch of sand that enters the mixer. The prepared sand is discharged through an opening in the bottom of the pan and falls into a box mounted on skids for the accommodation of an electric lift truck.

The coreroom is divided into three main sections. The first contains the benches and coremaking equipment including the racks on which the green cores are stacked before they are taken to the ovens. The second section is occupied by the core ovens and the third section is devoted to fitting, testing and assembling the cores before they are taken to the adjoining foundry on electric trucks. Views of the first section are shown in Figs. 1, 4 and 6, while many of the features that characterize the third section are illustrated in Figs. 2, 3, 5 and 7.

Five rows of core benches are arranged longitudinally in parallel lines extending from the core sand mixers to the core ovens. The two double

FIG. 5—CORES ARE TESTED FOR SHAPE AND DIMENSION IN A TWO-PIECE FRAME BEFORE THEY ARE TAKEN TO THE MOLDS

rows in the center are located back to back with a narrow gangway between for the passage of the truck bearing the core sand. Each bench is provided with a small bin into which the sand is shoveled from the truck. This arrangement leaves a wide space for loading the racks as shown in Fig. 1. A few of the smaller cores are made by hand, but the greater number are made on small rollover machines. No distinction is made between the work handled by the male or female operators with the single exception of the cylinder body cores in which the work is a little heavier than on any of the other cores. These cores are made exclusively by men in the section illustrated in Fig. 4. A helper is stationed between each pair of coremakers to remove the cores from the bench, black them, place them on the rack and keep the coremakers supplied with chills and arbors.

Use Sand Thrower

Body cores are made in a type of metal corebox that has been adopted universally throughout the automotive industry. It is made up of a base and four detachable sides held together by rapidly adjusted clamps. It is the product of a new school of patternmakers, men who combine a working knowledge of foundry requirements with the technical and manual skill of the metal die sinker. Where the old time patternmaker talked with respect of a sixty-fourth and referred to a hundredth with bated breath, particulary in the presence of apprentices, these men talk carelessly about thousandths of an inch and it is only when ten thousandths are specified on the dimensions that they begin complaining about the cussedness and crabbiness of designers in general. Recently a machine made by the Keller Mechanical Engineering Corp., Brooklyn, N. Y. has been installed in the pattern shop. A leader follows a pattern or corebox to be reproduced while a cutting tool generates the desired contours on the duplicate pattern or corebox.

The corebox is set up on the bench with the openings for the barrel cores resting on the base plate. The pipe arbors are placed one in each barrel where they are centered by projections on the plate designed for the purpose. Sand then is filled in and rammed by hand, struck off flush with the top, vented several times with a wire, after which a core plate is adjusted in place and the entire assembly is rolled over in an ingenious yoke suspended from a small air hoist. The coremaker removes the base plate and places it once more on the bench, then he rapidly removes the clamps, after which each of the four sides is lifted in turn and the entire set reassembled on the base.

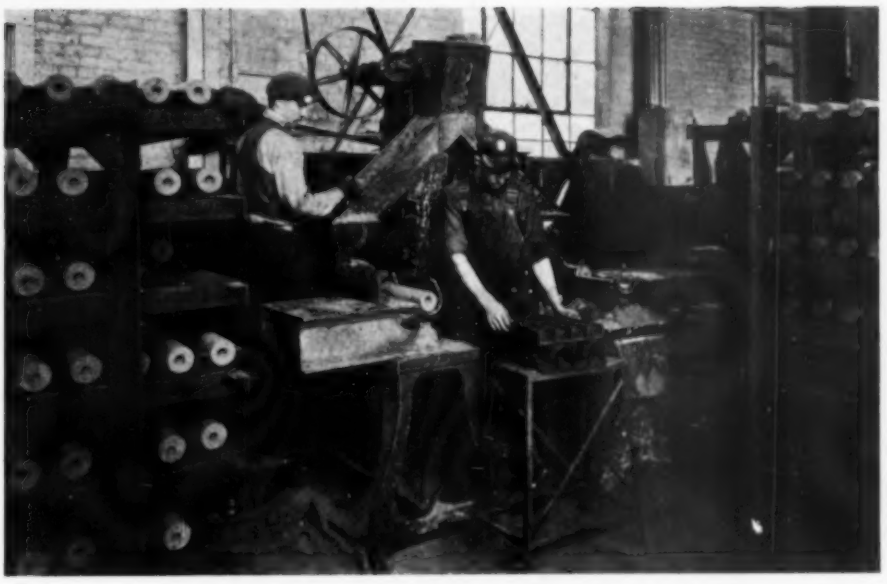


FIG. 6—BARREL CORES ARE MADE ON TWO EXTRUSION MACHINES COUPLED TOGETHER AND SERVED BY A COMMON SAND ELEVATOR

Recently a machine made by the Beardsley & Piper Co., Chicago, was installed in this section to speed production. It is a small stationary sand throwing machine and is served by a short oval roller conveyor on which 12 coreboxes are passed in rotation before the ramming head. A crew of 6 men manipulates the equipment. One man pushes the corebox under the stream of sand, a second man guides the stream, the third man pulls the box away, the fourth man takes it apart, the fifth man removes the core and the sixth man assembles the corebox and pushes it along to the first man. This cycle is kept up continuously with the set of coreboxes. The sand slinger and crew make 60 cores an hour. An equal number of men working with individual coreboxes make 20 cores in the same period of time. Among many of the advantages claimed for the former method is that the operating force may be recruited easily from unskilled labor.

Employ Core Driers

Individual barrel cores are made in several sizes on the ingenious device shown in Fig. 6. Two sausage type machines made by the Wadsworth Core Machine & Equipment Co., Akron, O., have been mounted side by

FIG. 7—WATER JACKET CORES ARE SURFACED ACCURATELY ON A DISK GRINDER BEFORE THEY ARE TAKEN TO THE ASSEMBLY BENCHES

side with a common sand supply elevator between them. Each side is controlled independently of the other and while both sides usually are operated together, occasionally one side may be stopped temporarily while the other side continues. The cradle which receives the core as it emerges from the die is provided with two wires which cut the core to the proper length. The attendant then places a drier on the core and holds it in place while the cradle, core and drier are rolled over on the plate. Two operators attend each side of the machine. One throws a clutch in and out, thus starting and stopping the augur which pushes the sand through the die. The other rolls the core in the drier and places it on a rack which is carried to the oven after it is loaded. For simplicity, speed and output it is claimed this method is in a class by itself, with an output of 5400 cores per day.

General features of the cast-iron, core driers may be noted in the illustration Fig. 6. They are ribbed and flanged to insure rigidity under fluctuating temperatures and are provided with vent holes which let the steam escape, hasten the drying time and prevent the sand from sticking to the face. Almost without exception green cores for automobile castings are placed in driers which support them until they are dried. Metal walls are so thin and machining tolerances are so meagre that the least sag or distortion in a core will spoil the casting.

Employ Disk Grinders

Several stages in the fitting, testing and assembling of the cores in the third section of the coreroom are shown in Figs. 2, 3, 5 and 7. Disk grinders are employed to surface the joint side of jacket cores and a coarse revolving brush is pushed vertically through the openings in one-piece cores to insure accuracy in dimension. For many of the castings the entire set of cores is pasted and wired together so that it may be lowered into the mold as a unit. Progressive assembly is practiced here as in the foundry. The cores are passed from hand to hand so that each employe may contribute his or her share. In this manner each employe becomes expert, confusion is avoided by stacking the various cores along the benches and the process is speeded up to the pace set by the fastest worker in the group.

Body cores for Chevrolet cylinders are made in pairs with two barrels integral with half the crankcase core in each unit. The method and equipment for testing them for accuracy of dimension and surface perfection are shown in the illustration Fig. 5. A two-part frame is provided with contact points corresponding to all points where the core touches the sand in the mold. The core is placed in the drag half of the frame and the operator with one swift look notes whether or not it rests perfectly. He grasps a large vent wire which may be noted hanging on a nail at the corner of the bench in the center foreground and breaks away the film of sand that has formed over the vent holes that were made in the green core. He then lowers the cope half of the frame into place and notes how it fits. Occasionally a core must be discarded, but for hours at a time the cores pass this station in a steady stream. The cores are piled three tiers high on skids and brought to the station on electric trucks and are taken away in the same manner. The core operator lifts the cores from the loaded skids, tries them in the frame and reloads them on a second set of skids when then are whirled away to the foundry. Three men test approximately 2500 cores every day.

British To Cast Bell for Philadelphia

A BRITISH company recently has received an order from America for a bell which will be larger than Big Ben and will have a deeper tone than the Great Paul of St. Paul's Cathedral. This bell, which is to be installed next May in the belfry above the Wanamaker store in Philadelphia, will be one of the largest in the world. It will be known as the Founders Bell in honor of John Wanamaker, the founder of the business who died three years ago.

The following message, which Mr. Wanamaker left to his associates, will be inscribed on the bell:

Let those who follow me continue to build with the plumb of honor, the level of truth and the square of integrity, education, courage and mutuality.

The idea for the bell originated with Rodman Wanamaker after he heard the broadcasting of Big Ben in London and it is probable that the new bell will be used for radio purposes.

Wanamaker's new bell will be cast and tuned on the system known as the five tone Simpson harmonic principle, which was used by the best bell founders of the Netherlands three centuries ago, and has been rediscovered and improved. The harmonic principle insures that the bell will be in tune with itself, that it will have at least five tones at correct intervals so as to form a perfect musical cord. By delicate calculation and craftsmanship, it will be possible to make the new bell sound low D, bass clef, or a half tone lower than the Great Paul.

The mold for the inner surface of the bell will be built of clay while the outer surface will be made with an iron mold lined with clay. The alloy used will consist of pure copper and tin, and the bell will be allowed to cool several weeks after being poured.

Will Prevent Iron from Eating into Core

Question: Will you kindly suggest a core mixture for a 2-inch core that is placed in the center of an iron casting 14 inches diameter and 14 inches in length.

Answer: The simplest and most convenient form of core for a casting of that kind is a piece of 2-inch steel tube filled with a mixture of sharp sand and sawdust. The tube will not melt but the pressure of the metal will squeeze it in, especially around the lower part if it is not stuffed with some solid material. The saw dust will prevent the grains of sand from fusing together. The core also may be made from a good grade of sharp sand bonded with a minimum amount of binder and covered with a good coating of plumbago or silica wash. The core should be dried almost to the point of burning and provided with a ½-inch vent hole in the center.

Employes handling molten metal and other hot substances should wear fire-resisting leggings made of asbestos or chrome leather. Canvas leggings can be worn if well made and fireproofed. Leggings should fit snug at the top and be free of buckle holes or other openings through which molten metal, etc., can reach the flesh. Suitable leggings should be worn by foundry employes, and by men working around furnaces, or handling acids and caustics.—*National Safety News.*

FIG. 1 — BRONZE FIGURE THE MOLDER

Commemorate Youth Etern

Mark Twain's Immortal Boy Heroes Reproduced in Enduring Bronze and Erected in a Prominent Position in the Missouri Town Where Their Mischievous Talents Were Exercised—Sculptor Noted for Foundry Art Work and A. F. A. Medals

FIFTY years ago Mark Twain wrote in *Tom Sawyer* "The locust trees were in bloom and the fragrance of the blossoms filled the air. Cardiff Hill, beyond the village and above it, was green with vegetation and it lay just far enough away to seem a Delectable Land, dreamy, reposeful and inviting." He never forgot that hill. In his biography written many years later and after he had covered a greater territory and experienced a greater variety of changes than fall to the lot of most men he shows how vividly the impression remained. "I can remember the drowsy and inviting summer sounds that used to float in through the open windows from the distant Boy Paradise. Cardiff Hill." In the course of a long and busy life he wrote of many places, many people and many things and he wrote of them all with a master hand, but to millions of people all over the world and speaking 30 different languages, he is best known and will be remembered longest through the two famous boy characters he created, Tom Sawyer and Huckleberry Finn. As a boy he grew up in the little Missouri town. He had all the contradictory tendencies and characteristics of the normal, healthy and happy boy and he had a sufficient infusion of the grace of God in his heart to retain a boy's outlook on life to the end. How else after the lapse of 20 years could he write so intimately of boy life in the town of his youth. Tom Sawyer suffered not the least qualm of concience in picking a row with a new boy who seemed too nice. He deceived his aunt by sneaking out through the bedroom window after he was supposed to have retired for the night. He calmly manipulated the market in Sunday school merit cards and brazenly claimed the prize to which he was not entitled. He ran away from home to be a red avenger on the Spanish Main, but when a clandestine visit revealed that his aunt was grieving over his supposed drowning his tough little heart melted within him, and he pressed a kiss on her faded cheek. Prospect of a lingering death in boiling oil would not have persuaded him to commit this act in the presence of witnesses or if his aunt had been awake.

FIG. 2—STATUE RECENTLY ERECTED TO TOM SAWYER AND HUCK FINN IN THEIR NATIVE TOWN, HANNIBAL, MO.

Those who have read the story will require no explanation to account for its appeal and universal popularity. Those who have not read the story or rather several stories in which the same characters appear, will prefer to take them up boy fashion, sight unseen. Locust trees again were in bloom this summer and the fragrance of their blossoms filled the air when a bronze statue of the two inseparables erected on north Main street at the foot of Cardiff Hill was presented to the city of Hannibal, Mo., by attorney George A. Mahan and accepted in the name of the citizens by Mayor Morris Anderson. The city staged a notable demonstration for the occasion with parades and bunting, school children, boy scouts and a detachment of the National Guard. The years have been many and the years have been long since Tom rambled barefoot and happy through the streets of Hannibal, careless and contented with a laugh for the present and a delightful disregard for the future. Huck Finn and Nigger Jim long since have gone the way of the flesh. The dramatic passing of Injin Joe, barricaded in the cave, vainly trying to carve a way to freedom through the solid rock and depending for a drink on the

water that dripped from a stalactite and collected in a cup on a stalagmite at the rate of a spoonful in 24 hours, has satisfied the justice loving sense of millions of readers who hold to the primitive doctrine of an eye for an eye and to tooth for a tooth.

Mark Twain himself has answered the final roll call. The engine room telegraph has rung *stop* for the last time on the *Big Missouri*, but the characters he created probably will be known and loved by succeeding generations so long as books endure. A tangible and vibrant link between the past and the present, between the real and the visionary was present at the celebration in the person of Mrs. Laura Frazer now and for many years a staid and charming matron, but at one time no less a person than Miss Better Thatcher. The young lady who caused Tom's boyish heart to alternately expand and contract, depending on whether she chose to favor him with a smile or a contemptous curl of her little pug nose.

Sentiment of readers the world over was voiced by Major Norris Anderson who in accepting the statue in the name of the city said in part:

To appreciate this statue you need not know books, you need not know art; all you need to know is eternal youth, for Tom Sawyer and Huckleberry Finn are the personification of youth. If they did not represent boyhood the world over, these stories would not have been translated into some 30 different languages.

To appreciate the spot on which this monument stands, you must be a dreamer. You must be able to reincarnate the past, to change the setting of the stage. To forget the sound of the bell and the horn and the whistle, the clatter of paved streets and the fact that some 20,000 people are working, planning, rejoicing, sorrowing all about you. The city fades away and we see again the village of yesterday. This is Cardiff Hill. On the top is the home of Widow Douglass, burned these 30 years and more. It was there that Huck went to be civilized and where Nigger Jim was a slave. Just a few feet to the east, upon the corner stood the jail where Muff Potter was a prisoner. Down this hill Tom Sawyer and his gang rolled great rocks to scare the passers by. Upon this alley to the right stood the home of Huck Finn, when he was not using a barrel for his apartment. Just through the alley on the next street was the home of Tom Sawyer, only a few hundred feet from the river they both loved so well. The river gave them access to Jackson's Island, the cave, the mysterious and winding streams on the Illinois shore. Down this river Huck and Nigger Jim floated on a raft in search of adventure and freedom.

As mayor of the city I am called upon many times to welcome conventions, delegations and distinguished visitors and it seems fitting to me that I should welcome these boys who have come back to us after so many years. Looking on this statue I feel as if some person had opened Mark Twain's book and you in a spirit of adventure had stepped out of the pages on to this granite block. From this new vantage point you look out now on the present world with the eyes of yesterday.

Mr. Tom Sawyer and Mr. Huck Finn, we are proud to welcome you to Hannibal and we are sure you enjoy this demonstration. You loved to be the center of attraction. You loved an audience and because of this

FIG. 3—BRONZE FIGURE OF MARK TWAIN FIRST SHOWN AT THE CHICAGO CONVENTION AMERICAN FOUNDRYMEN'S ASSOCIATION IN 1914

lovable boyish trait in your character you never could make up your mind whether to be a circus clown or a red avenger on the Spanish Main.

Knowing you two as we do we shall not be surprised if some dark night when the clocks strike 12 and the dogs howl and the owls hoot, you jump down from this granite pedestal and climb over the hill to once more play Robin Hood in the depths of Sherwood forest or seek to justify superstitious belief in buried marbles, or to hold converse on the river bank with Joe Rogers and his robber band.

Many things have changed in the world but a great deal remains as it was yesterday, is today and will remain forever. Human nature, dreams of adventure, of happiness of youth, as long as these last the world will love Tom Sawyer and Huckleberry Finn. Many will look upon you here with fondness in their hearts and because this is so I am glad to welcome you back today—back home.

Walter Williams dean of the school of journalism. Univresity of Missouri, Columbia, Mo., delivered the principal address from which following is extracted:

These statues constitute a tribute to the eternal boy. Mark Twain's boys—as boys should be—were not little men—God save the mark! Nor were they, despite Kimball's illustrations, boys from the tenement houses in the slum districts, hard faced, thin visaged and cruel. They were out door boys, alert, full limbed, happy, adventurous with a twinkle in the eye and they were often dirty. They were unspoiled by uniform education. They were individual, as boys should be, original, not made into the same mold by the too rigid enforcement of scholastic sameness.

We are threatened continually because of the non-youthfulness of the age, because of the hardening of the arteries of the mind, with seeking to make our boys all alike or all like us in school and home. I can conceive of nothing worse for the boys that are to succeed us than to be in everything alike and in all things like those whom they succeed. A suggestion of freedom for boys is presented in this statue. It is a protest I trust against that over censorship of speech and morals that is far worse for boys than the utmost freedom. Character, self developed by a self reliant boy, stands the great test. Enforced conduct fails and falls when the scaffolding of compulsion is withdrawn.

Carelessness A Virtue

No person can look upon this group without rejoicing in the fact that there are yet boys who are free and joyful and, if you please, for the time utterly careless. We have too many traffic regulations these days for the spirit of man.

* * *

Let us keep our boys as boys, free from bureaucracy and departmentalized straitjackets. If they are permitted to roam at will upon the hill side and the woods, they will not be forced in rebellion against undesirable uniformity and absurd autocratic regulations into the subways of inferiority or the alleyways of vice.

This statue I think will plead that the democracy of boys may be taken over into the slower and more cautious years that follow. Tom Sawyer plays with Huckleberry Finn and Huckleberry Finn plays with Tom Sawyer and both play with every boy in the neighborhood without distinction. Only as we become over cautious with years, conservative, suspicious and snobbish do serious difficulties arise. Boys make their own league of nations. Only grownups without any of the saving grace of youth need and use boundary lines,

bombs and letters of introduction. Today we need renewed emphasis upon tolerance and democracy. We may learn if we become boys again.

The statue was conceived, designed and modeled by Frederick C. Hibbard, a noted sculptor of Chicago well known to the foundry industry through his contact with it on several occasions. He was responsible for the large bronze figure of Mark Twain erected at the intersection of the main aisles in the main exhibit in the international amphitheater during the convention of the American Foundrymen's association in Chicago in 1914. The bronze statue of *The Molder* Fig. 1 was fashioned from a life study in the plant of the Michigan Malleable Iron Co., Detroit. It has been admired at many art galleries during the past year and was awarded the gold medal of 1924 at the Kansas City midwestern artists exhibition Feb. 1924. Mr. Hibbard designed and afterward made the models and dies for the medals of merit to be awarded from time to time by the American Foundrymen's association and shown in the accompanying illustrations.

Readers of THE FOUNDRY will remember that the four contributions which these medals were to commemorate were announced at the Columbus, O., convention of the association in 1920. Cash gifts each totaling $5000 were offered the association, the income to be used in making awards and giving prizes for the encouragement and stimulation of effort in the metals casting industry. The donors were Joseph S. Seaman, third president; William A. McFadden, tenth president of the association; J. H. Whiting, manufacturer and John A. Penton first secretary of the association. All charter members when the association was founded in 1896.

Heroic Statues

Most of Mr. Hibbard's work has been on heroic portrait statues and martial monuments for city and national parks and includes statues of Gen. James Shields, Carrollton, Mo.; Col. Alexander A. Doniphan, Richmond, Mo.; Gen. U. S. Grant, equestrian statue, Vicksburg national park; Gen. Lawton, Fort Wayne, Ind.; Dr. G. V. Black, Lincoln park, Chicago and many others.

Ordinary pottery clay was used for modeling the statue of Tom Sawyer and his boon companion, Huckleberry Fin. It stands about 7 feet high to give the proper perspective when viewed from the street and is mounted on a base 3 x 4 feet. For convenience in casting the group was cut into four main sections: The base, one of the figures complete, the second figure in two parts. The arms also were cast separately and afterward riveted to the main figure through a *Roman joint*, a trick of the trade that is almost as old as the history of statuary and so perfect in its simplicity that it never has been bettered. Briefly the adjoining parts are fitted with a male and a female joint and after they have been adjusted and held in place with one or two bronze pins, the entire edge of the joint is peened and then filed or scraped. The soft metal *flows* to such an extent that the joint line cannot be detected. Large bronze sections are bolted through

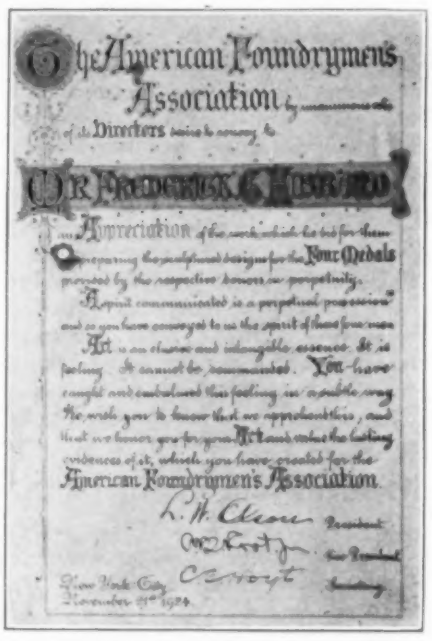

The American Foundrymen's Association
Appreciation
Four Medals
American Foundrymen's Association
New York City
November 4th 1924

FIG. 4—FACSIMILE OF APPRECIATION PRESENTED THE SCULPTOR WHO DESIGNED THE MEDALS. FREDERICK C. HIBBARD

internal flanges provided for the purpose.

Molding bronze statuary involves a rather elaborate process whether the casting is made in a sand mold or in a composition according to the *cire perdue* or lost wax method. A profusely illustrated article on the first method was published in THE FOUNDRY, July 1, 1924. In the present instance the castings were made according to the lost wax method in the foundry of the Chicago Art Bronze Co., Chicago under the direction of Richard Fay.

A *waste* plaster mold first was found around the clay figure and after it had hardened sufficiently it was taken apart and the clay was removed. The face of the mold then was cleaned perfectly and anointed with vaseline after which the mold was reassembled for the reception of a plaster cast. In the small molds the interior was filled entirely with plaster. On large parts the plaster was built on to the face of the mold to a suitable thickness and if necessary reinforced with wires or rods. The waste mold then was removed and destroyed in the process, leaving exposed a plaster replica of the clay model.

Wax Is Melted

Taking each part of the plaster pattern in turn a plaster mold was built up in sections around the outside. Each of the sections was provided with suitable guides to locate it in place with relation to adjoining parts. Also it was shaped in a manner that allowed it to be withdrawn readily either from the plain face or an undercut portion of the pattern as the case might be. The mold was removed from the pattern and reassembled and then filled with molten wax. The wax was allowed to stand until a skin had formed to a thickness of approximately ¼-inch and then the remainder was spilled out. On the large patterns or those on which the shape lent itself better to the operation the wax was painted on to the desired thickness.

A special core mixture which Mr. Fay does not care to disclose was rammed inside the wax thickness and then the entire mold firmly bound together, was surrounded by a temporary brick oven in which the temperature was raised to a sufficient point and held for a sufficient time to melt all the wax and remove it from the mold. The long wax strings arranged at the time of building the mold to form gates leading from a common point to various parts of the casting, also were melted out at the same time. The mold then was secured in a suitable manner and the metal poured into a basin on top which communicated with the various runners and distributed the metal uniformly and quickly all through the cavity left by the wax.

Modifications of this method are followed where duplicate castings are required. In some cases the outside part of the mold is removed after the core has been rammed inside the wax thickness. A new outside then is built up without any parting lines and this casing serves as the mold. The plaster piece mold in this manner may be used to make as many wax reproductions as may be required. A new core is required each time. On other castings, gelatin is used instead of wax to form the thickness. This material is tough and may be removed from quite intricate molds and cores. The molds then are reassembled and poured without the necessity of melting the wax from the interior.

How and Why in Brass Founding

By Charles Vickers

Litharge Slags Antimony

Will you kindly advise us if a softening furnace, such as is used in lead refining would be suitable for the removal of antimony from white metals containing lead, tin and antimony, so the alloy could be used in making brass, as we have an accumulation of such metal.

The antimony can be removed by oxidation, which in a brass foundry would mean the loss of the metal. If the alloy is melted in a kettle, litharge strewed on top, and the heat is increased to the point where the litharge melts, this substance will be reduced to lead and the antimony will enter the slag and thus be removed. In the case of alloys containing tin, the latter metal would also be removed, and soft lead remain. The refiner of such metals, reduces the oxides of the metals he removed from combinations of metals and thus saves them. If the analysis of the white metal is known it could be made into an antifriction metal such as the alloy lead 80 per cent; antimony 15 per cent; tin 5 per cent, and this alloy could either be sold as a lead-base babbitt, or it could be used for babbitting journal brasses.

Temperatures Differ

We are pouring mill brasses in our repair shop and we note much difference in the brass when poured at the same temperature. Could you advise us in regard to the proper temperature at which these brasses should be poured? The castings weigh from 40 to 600 pounds each.

Pouring temperatures are affected by a number of factors, such as the composition of the alloy, the quality of the molding sand, the manner in which the mold is constructed, and we might add individual preferences. All these have a bearing on the temperature of the metal when it is poured into the mold. Also a casting of a few pounds weight should not be poured at the low temperature that might be satisfactory for one of 600 pounds weight.

Therefore, there is no *proper* pouring temperature for pouring all castings as far as the use of pyrometers has gone. Should we be mistaken in the opinion of those interested, it will be a pleasure to us to be corrected, and we shall be glad to have them come forward and give the *correct* pouring temperatures for all castings. We do not believe that any one as yet, has carried out the research necessary to determine at what temperature any casting should be poured to have it come good, or better than at some other pouring temperature. In fact experience has taught those with knowledge in such matters that pouring temperature is less important than the temperature to which the alloy has been brought in the furnace, prior to its removal therefrom. All alloys should be heated until highly fluid, and then after removal from the furnace they can be cooled to suit the mold to be poured, which, of course, requires experience in making castings. This only can be learned by years of work in the foundry, as it cannot be picked up cheaply in colleges.

Wants Acid Proof Bronze

We require a bronze that will resist the corrosive action of water that sometimes contains as high as 6 per cent sulphur, and it must also have strength enough to withstand high pressures and velocities. We would also like some information regarding monel metal and its suitability for shaft sleeves, wearing rings and impellers.

An alloy of 75 per cent copper; 10 per cent tin, and 15 per cent lead is used by one large manufacturer of pumps for acid mine waters. Another alloy is copper 86 per cent; tin 11 per cent; zinc 2 per cent; lead 1 per cent.

Monel metal contains approximately nickel 67 per cent; copper 28 per cent; with 5 per cent other metals such as iron, manganese and silicon. The metal is reduced from an ore occuring in the Sudbury district of Ontario, Canada.

It can be cast, forged, rolled and stamped and withstands some corrosive agents better than other alloys. Monel metal withstands sulphuric acid very well and therefore finds application as a material for the construction of pickling crates, tank tie rods, nut washers, hooks and bales, etc. It is an alloy well worth a trial for making the mechine parts mentioned in the query.

Analyzes Two Solders

We would like to obtain the formula for an aluminum solder melting at a low temperature.

Either of the two solders following are suitable: 1—Tin, 56 per cent; zinc, 38 per cent; copper, 3 per cent; aluminum, 3 per cent. 2—Tin, 58.50 per cent; zinc, 38.50 per cent; copper, 3 per cent.

If the solder that has been used has proved satisfactory it would be advisable to have a complete analysis made, then make up to the formula thus revealed. We believe though that more satisfactory results will be had by continuing to purchase the solder from the manufacturer than to attempt to imitate it. Undoubtedly, both time and money have been expended in perfecting the alloy to the point where it gives satisfaction, and it can be assumed there were a number of kinks that had to be ironed out, before a marketable product was arrived at. Ignorance of these difficulties will prove a great stumbling block to imitators. Of course, if the maker has retired from business it will be necessary to either make the alloy or find a substitute.

Wants Cheap Metal

We are looking for the cheapest rust-proof metal that will machine good and will withstand about 10 pounds pressure, and which would not be porous. This metal is for a centrifugal pump which varies from one-third to one-fourth inch thick and is to be used in soapy water and may affect the metal to some extent.

Any ordinary red brass will be suitable for the purpose outlined; an alloy consisting of copper, 85 per cent; zinc, 5 per cent; lead, 5 per cent, and tin, 5 per cent, would be suitable. A fair price for such castings would be around 15c per pound over the price of the metals, and it is probable it would not be difficult to get the castings made at that price which does not permit of any extravagant profits.

The above suggested alloy is not the cheapest alloy that can be made but it possesses quality, and quality and cheapness are rarely found together. It will withstand the soapy water and last as long as any part of the washing machine.

Bonus Plan Advantageous

Scheme Worked Out at Malleable Iron Plant Has Proved Satisfactory in Solving the Wage Problem in the Foundry

By B. R. Mayne

THE malleable iron plant of the Saginaw Products Co. is engaged entirely in the founding of automotive castings for several automobile manufacturers. The demands from the customers for malleable castings include a great variety of parts, but this variety may be termed uniform to a great degree. Every car produced carries the same variety of malleable castings, consequently, as car production increases, the variety of work remains the same, and only the volume of work increases. Therefore, it can be seen why group bonus is applicable to this type of work.

At our malleable iron plant 17 groups are in operation under the group bonus plan, and all are controlled by the same *unit of measure* for work done, that unit is per 1000 pounds of customers good castings, which is a daily figure from the daily foundry report. This report is complete within 36 hours from the time the last casting is poured for that day.

Before going into details concerning the various groups, it is quite necessary to illustrate how and when a bonus should be paid to a group. Assume for example any one foundry operation which requires 16 men, working 10 hours per day, to complete this operation thoroughly and in such a way as to keep pace with the daily production of 80 tons of customers good castings. At once a unit of measure must be established and that unit will be per 1000 pounds customers good castings. Under the foregoing assumption there has been applied to this operation 160 actual working hours and the average weight handled per day has been 160,000 pounds.

Here is a direct relation between tonnage and actual man hours, which in this case is 1.0 hours per 1000 pounds of customers good castings. This has been strictly on a day work basis with an hourly rate of $0.40; thus, the direct labor cost would be $0.40 per 1000 pounds. All concerned are well satisfied that the men are giving a fair day's work at the present rate, but feel quite certain that they could not get this operation done more rapidly without the addition of more men, also tools and floor space, or an increase in the hourly rate, with no assurance that the time would be decreased.

As an attempted solution group bonus is applied upon an efficiency basis; therefore, an allowed number of hours must be given to do this work, and this is called standard time hours, against which the actual hours are compared in a ratio of standard time hours to actual hours. This gives a percentage ratio, which applied to a table of percentage efficiencies as shown in the accompanying table gives the amount of bonus to be paid.

It will be noted that bonus payment begins at 75 per cent efficiency. In the above case the management deems it worth while to pay a premium for more rapid operation, but still maintain a fixed cost, not to exceed $0.40 per 1000 pounds of customers good castings.

Plan Requires Diplomacy

To institute group bonus care must be taken and good salesmanship practiced upon the particular group to be so started. So often it is mistaken as a ruse to exact a little more from the employes with no proportionate return. First, leave the hourly rate the same; set the standard time hours in this case at 0.74 hours per 1000 pounds, or a total of 118.4 allowed hours per day, at the average tonnage of 160,000 pounds.

It is quite obvious that the group still maintaining their same pace of 16 men for 10 hours a day would be 74 per cent efficient or still earning $0.40 per hour. The next period, suppose they are 100 per cent efficient, this pays a 20 per cent increase or a total of $0.48 per hour, but only over a shorter time. The total money paid in the case of 100 per cent efficient is $56.83 (118.4 actual hours per day x $0.40 plus 20 per cent bonus) per day direct labor cost.

In the case of the 74 per cent efficient or day work proposition it was $64.00, consequently, the employes are given an increase of $0.08 per hour, while the management has reduced direct labor cost $7.17 per day with a cost of 1000 pounds of customers good castings of $0.355. This last mentioned figure may then be established as a standard cost, as for any efficiency above 100 per cent this cost per 1000 pounds remains constant. To illustrate, suppose the group efficiency was raised to 120 per cent, this means that 98.6 actual hours have been put in total by the group at the rate of $0.576 per hour or a direct labor cost of $56.85 per day or $0.355 per 1000 pounds of customers good castings.

Guaranteed Hourly Rate

Under the bonus wage plan an employe receives a guaranteed hourly rate which is set at a fair point for the community, and for the class of work. The bonus system gives the group of individuals an opportunity to increase their hourly earnings to a predetermined scale of payment. Payment of this bonus is made at the end of a two weeks' pay period and one pay check includes the hourly base rate for the total actual hours and the per cent of this total according to the efficiency maintained throughout the pay period.

Time recording and crediting the various groups for units of work done first is started by a foundry time checker. Group check sheets are prepared daily for each group. These check sheets carry the list of man numbers and the actual hours worked for that particular day. The group check sheets are forwarded to the payroll department in conjunction with daily credits or units of work

Offers Advantages

INCREASED production is one of the benefits which, it is said has resulted from the plan of group bonus wage payment, as maintained at a malleable plant. The plan, as operated by the Saginaw Products Co., Saginaw, Mich., is described in this article, which is abstracted from a paper presented at the Syracuse meeting of the American Foundrymen's association held Oct. 5-9, 1925. The author is plant manager of the Saginaw Products Co.

done which is given out by the production department.

The payroll department then lists the clock card numbers of the men in the group on what is called a group bonus card, and the actual hours of each man employed in this group is posted daily, the total of each day being taken and carried forward in a cumulative figure. The number of units of work done each day also is entered and multiplied by the standard time hours to get the total of standard credit hours due the group.

Groups in this plant range from groups of two men to approximately 50 men. A better idea of a group bonus card can be obtained by referring to the accompanying illustration taken from the payroll ending June 30, 1925, and is an actual working condition for a two-man group.

Turning now to the cost end, it will be seen that the bonus card of a group working the entire period on one operation will contain the number of units of work done and also the total amount of money expended for direct labor, giving an accurate direct labor cost per unit or per pound on that particular casting.

Time Studies Used

In establishing rates for molding operations both individual and group time studies are made. A rate is given the molder or molders as the case might be, in molds to maintain 100 per cent efficiency, not pieces per hour or money per piece but in molds per hour. The rate, if met by the molder nets him a 20 per cent increase on his base rate. As a further inducement, if a molder maintains an efficiency of 100 per cent or over, for a pay period, his base rate is automatically increased $0.05 per hour, and the resulting bonus payment is computed from this new base rate.

This practice is in force only in the molding department. However, in placing so many molds for 100 per cent efficiency, it is an understood fact that every mold shall produce good castings, the molder sustaining a loss for faulty work as is quite in keeping with all foundry practice.

Time study also is employed in establishing rates for core making. This operation involves no group, all work is individual bonus. Rates are given in pieces or cores per hour to maintain 100 per cent efficiency, the same deduction holding true in the case of careless work as in molding.

Time study of a group operation is not made from individual studies within the group but from the standpoint of the required total production and actual working hours necessary to reach this point with sufficient allowance that this particular group will not become a choke point in production. Preliminary to establishing a group standard time considerable care must be taken in working out an efficient plan of group operation with a logical arrangement of equipment and material. Then with an organized group they are ready to be placed upon an efficiency basis for measuring their skill and speed of operation. Daily efficiency figures are issued to the various groups, which also carry a cumulative efficiency to the last date, as well as the daily efficiency, giving a very graphic picture to the groups as to their progress toward earning more money.

Core Room Work

In the coremaking department, all contingent labor is carried by three groups, core room labor, core delivery and core assembly. Core room labor is composed of both male and female workers, numbering about 26 in total. The operations of this group are quite numerous and varied, consequently they are subdivided, but are maintained as one group to facilitate many changes of work during the day with no time checking necessary. The first subdivision includes all labor necessary to the coremakers benches. Sand wheeling to coremakers, carrying away green cores, wire cutting, rod cutting and salvage, chill sorting and inspecting, also keeping all core driers sorted and ready.

The second subdivision includes: sorting of baked cores, cleaning and inspecting, placing cores in core delivery boxes, and removing cores to core storage compartments.

The second main group operates under the present schedule of production with ten men. This operation is more distinct as it includes only delivery of cores to the molders' floors and the returning of the empty core delivery boxes to the sorting group. It calls for six men working days and four men nights.

The third group, core assembly, is a five-man group. This group, however, is based upon hourly piece production with a specified rate of cores assembled per hour for all five men to be 100 per cent efficient. The operations include: jigging, filing, venting, and pasting of two halves to form one core, with one man on each of the above operations.

Foundry Groups

The foundry proper operates with three separate groups, one group pouring iron, one shifting weights and molds, and the third operating bull ladles of 350 pounds capacity traveling on a monorail. The number of men on the pouring group varies directly with the tonnage. At the present the group contains 28 men, pouring four heats per day. This comprises about 40 per cent of the total working hours. The remaining 60 per cent is classed as foundry labor and is a straight day work proposition, which includes foundry clean-up, trimming and trucking of castings to a central point where all sprue is

Bonus Card for Two-man Group

Pay Period Ending June 30, 1925 **Operation Name—MOLDING** **Group No. -11-5**

		Hours		Clock Numbers and Base Rates	
Part. No.	255.174				
Page. No.	V-462			11,110	11,212
S. T.	.0555	Stnd.	Act.	.50	.50
Date					
16	596		20.0	10.0	10.0
17	432		20	10	10
18	494		20	10	10
19	492		20	10	10
20	239		12	6	6
21					
22	466		20	10	10
23	447		20	10	10
24	450		20	10	10
25	371		19.6	9.6	9.8
26	581		20	10	10
27	178		14.2	7.1	7.1
28					
29	628		20	10	10
30	527		20	10	10
Totals	5901	327.5	245.8	122.9	122.9
Less Allowance					
Net Hours					
Per cent Efficiency	133.0	Base Amt.		61.45	61.45
Per cent Bonus	59.6	Amt. Bonus		36.62	36.62

SUMMARY COST OF GROUP

Total Base Amount	122.90
Total Bonus	73.24
Total Cost of Group	196.14

REMARKS

broken, the cutting and conditioning of sand piles between the morning and afternoon heats.

This arrangement is advantageous from the fact that it permits continuous molding throughout the heats with no decrease in production, giving approximately 1250 pounds of customers good castings per day per molder.

Night Work on Bonus

Night foundry work is carried as a group bonus operation from the fact that a certain specified amount of work must be done previous to the next day's heat. The labor is identical with the foundry labor previously mentioned. This group is dependent upon no other factor than its own working hours, where in the former case, the amount of labor between heats can not be controlled as that is dependent upon furnace operation.

Based on Oil Consumption

Melting also is a bonus proposition, but the standard for operation in this instance is based upon oil consumption in gallons per ton of metal melted. Oil consumption is taken from the time the furnace is fired until the furnace is completely poured off. A fixed number of gallons per ton melted is the standard rate of oil consumption.

The ratio between the standard rate and the actual gallons per ton melted is the resulting efficiency of that particular furnace. The men's earnings are increased consequently by the economy of operation. This plan has netted a tremendous saving in fuel oil and decreased the amount of refractories used in furnace repair.

Hard iron milling, sorting and grinding are operating as three separate groups with a standard time rate per 1000 pounds of customers good castings for each group.

All hard iron scrap is taken out during these operations and the proper deduction is made for molders' loss, etc. The total scrap is then deducted from the total poured per day and the weight of customers good castings is thereby determined daily.

Tunnel Kiln Aid Bonus

Annealing is done in a continuous tunnel kiln, castings being packed in pots, placed on cars and moved to a charging line. At one end of this line cars also are unloaded from the discharge line. This group operates with a minimum of 14 men with a standard time rate in hours per 1000 pounds of customers good castings and with a differential credit in standard hours for all tonnage over 800 tons annealed per pay period. This has a tendency to encourage better and closer packing which is a requisite to good annealing.

The soft iron mills for cleaning after annealing also are on a similar tonnage basis for castings milled and delivered to the shipping department. This group is composed of 14 men, seven working days and seven nights. The soft iron cleaning also includes all sand blasting for which there are two mills. Both day and night crews are paid the prevailing efficiency bonus as earned by the entire group, inclusive of the sand blasting.

The shipping department makes all necessary finishing operations contingent to turning out good commercial castings. This group averages from 30 to 50 men, varying with the plant production. The operations are quite diversified, but with all the men on the various operations working to one end, that of keeping the total actual hours per day as low as possible, thereby maintaining a good efficiency. In this department all sorting and bagging is done, all straightening, swedging and gaging, all drop hammer and hydraulic press work on heavier castings, in fact, everything necessary to produce a finished product.

The foremen of the different groups have been placed in a group to enable them to increase their monthly earnings. This group is not operated or controlled by production but by the total of three costs: productive labor, expense labor and expense material.

The lowest total for the three accounts was established as a standard cost, any figure below this resulted in a definite percentage increase in earnings and established on a scale giving a greater return to the foremen for a consequent further reduction in these three items. It is hardly necessary to relate the direct results. The percentage of scrap loss in hard iron decreased between 35 and 40 per cent and the aggregate of the three cost accounts never has been over the standard established. Further, the foremen have increased their monthly earnings from 8 to 12 per cent with an obvious saving to the company.

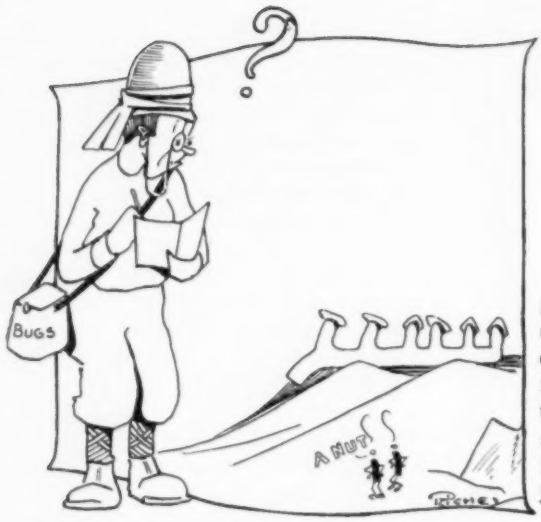
Summary

The group bonus plan of wage payment has been used at the malleable iron plant of the Saginaw Products Co. for about four years. Various changes have occurred and in some cases it was found impractical to carry certain operations on a group bonus plan, and several objections still can be raised. Necessary to the working of a group bonus plan there are a few prime requisites, otherwise, day work proves the most adaptable. First, the groups must be arranged logically as to operation, which are as near repetitive as possible. The foreman as well as group individuals must be 100 per cent sold on the idea. The standard time rate should be established only when increased efforts by the group begin to yield a return, and a bonafide assurance that no change will be made in standard time rates for a definite period, thus, they are guaranteed their earnings regardless of how great the increase for at least one pay period. It is quite necessary that the groups be given periodic statements as to their status, these statements carrying a daily efficiency with actual and standard group hours, also a cumulative efficiency including the date of issue, consequently, at the end of the pay period a group statement carries the efficiency at which the group will be paid.

The plan of group bonus wage payment as maintained by the Saginaw Products Co., malleable iron plant, has resulted in increased production throughout the plant, decreased work in the payroll department, an accurate check on all men with the resultant opportunity to weed out laggards, assisted the employment department by allowing them to guarantee an applicant for work a fair and just day rate, and has given the company a satisfied working force, thereby reducing labor turnover.

Bonus Table Productive Workers

Per cent Eff.	Bonus	Per cent Eff.	Bonus	Per cent Eff.	Bonus
75	1.	117	40.4	159	90.8
76	1.6	118	41.6	160	92.0
77	2.2	119	42.8	161	93.2
78	2.8	120	44.0	162	94.4
79	3.4	121	45.2	163	95.6
80	4.0	122	46.4	164	96.8
81	4.6	123	47.6	165	98.0
82	5.2	124	48.8	166	99.2
83	5.8	125	50.0	167	100.4
84	6.4	126	51.2	168	101.6
85	7.0	127	52.4	169	102.8
86	7.6	128	53.6	170	104.0
87	8.3	129	54.8	171	105.2
88	8.8	130	56.0	172	106.4
89	9.4	131	57.2	173	107.6
90	10.0	132	58.4	174	108.8
91	11.0	133	59.6	175	110.0
92	12.0	134	60.8	176	111.2
93	13.0	135	62.0	177	112.4
94	14.0	136	63.2	178	113.6
95	15.0	137	64.4	179	114.8
96	16.0	138	65.6	180	116.0
97	17.0	139	66.8	181	117.2
98	18.0	140	68.0	182	118.4
99	19.0	141	69.2	183	119.6
100	20.0	142	70.4	184	120.8
101	21.2	143	71.6	185	122.0
102	22.4	144	72.8	186	123.2
103	23.6	145	74.0	187	124.4
104	24.8	146	75.2	188	125.6
105	26.0	147	76.4	189	126.8
106	27.2	148	77.6	190	128.0
107	28.4	149	78.8	191	129.2
108	29.6	150	80.0	192	130.4
109	30.8	151	81.2	193	131.6
110	32.0	152	82.4	194	132.8
111	33.2	153	83.6	195	134.0
112	34.4	154	84.8	196	135.2
[illegible]	[illegible]	155	86.0	197	136.4
114	36.8	156	87.2	198	137.6
[illegible]	[illegible]	157	88.4	199	138.8
116	39.2	158	89.6	200	140.



Bill on How To Make a Lead Kettle

By Pat Dwyer

EXTENT to which THE FOUNDRY is justified in its slogan *Wherever Metals Are Cast You'll Find* THE FOUNDRY is exemplified nearly every month in the year by visits to the home office of foundrymen from practically all over the world. They read the paper in their own home town in any of the great divisions of the earth and then when the opportunity presents itself they come in to see where, how and why the wheels go around. They know that the latch string always is hanging invitingly outside and a cordial welcome awaits them inside. Many of these men the editors know through correspondence and though formerly separated through time and distance we greet them familiarly as brothers in the ancient and honorable art of founding in metals. Others whose names hitherto have been unknown are welcomed as cordially and what facilities we have are placed cheerfully at their disposal. Whatever measure of pleasure or profit the visitor bears away we feel that we have been the gainer by the few hours of intercourse. We learn of foundry practice and conditions—social, political, economical and financial in other places and realize more fully the truth of the trite old saying that the world is a small place after all. With minor variations due to local conditions the problem of producing castings on a profitable basis is the same all over the world. Resourcefulness in overcoming difficulties and surmounting obstacles is not confined to the foundrymen of any one country or to any one race of people. Methods of production, daily output and character of castings may vary, but the final result is the same. In the language of the man in the street its a hard old row to hoe, but they all get there just the same.

Reports of tourists visiting foreign countries usually are incomplete, inaccurate and misleading. They see a few obvious points of interest, gather a few general impressions, pick up a few stray pieces of gossip here and there, frequently from irresponsible authorities, draw a few hasty conclusions based neither on common sense nor trained observation and then give out interviews whole heartedly condemning foreign countries because the habits and customs of the people do not coincide with those to which they have been accustomed at home.

The fact that the people of foreign countries are comparatively happy and contented, that they have a patriotic love for their native land, that manufacturing enterprises are carried on in a satisfactory manner and on a sufficient scale to meet all requirements, that commercial business is flourishing and transportation facilities are adequate to the needs of the population, all these features calmly are ignored.

From their lofty pinnacle they cannot conceive how a people speaking a strange and alien tongue and living under a form of government of their own choosing, possibly can have any conception of law and order or of the ten commandments. They conveniently forget that a sense of right and wrong is a natural and not an artificial attribute. They are obsessed with a burning desire to send missionaries to heathen lands to teach English and Christianity to a people who were civilized before Europe was in its swaddling clothes, who had a spoken and written language centuries before the ancient Britons had arrived at the stage where they stained their bodies with woad in lieu of clothing, a people who practiced an exalted form of religion before the Shepherd Kings of Galilee had the first inkling that a miraculous star was to appear in the East and lead to the lowly crib of Nazareth.

Descriptions of conditions by native or acclimated sons of Peru, Persia or Piccadilly present many features in marked contrast to the sweeping conclusions laid before a careless and credulous public by the *dot and carry one* tourists or by many enterprising journalists who are paid space rates. Tourists touch a few of the high spots. I know a lad who thinks he is perfectly qualified to discuss China because he was ashore in Shanghai for a few hours while his vessel was coaling in that port on one occasion. Professional correspondents assimilate local color while seated comfortably on a hotel veranda with a tinkling glass at their elbow. Occasionally they interview a prominent citizen and since human nature is the same the world over the prominent citizen puts his best foot foremost and shoots the bull with great skill and precision. The

BENEATH THE SPREADING CASTINGS TREE THE VILLAGE FOUNDRYMAN STANDS

correspondent usually is a bit of an artist himself and the copy he sends home is distinguished more for its readibility than for its accuracy.

The average tourist visiting a foreign country never sees a foundry. In fact taking him by and large he does not know whether castings are hatched in an incubator or grow on trees. Some of the more intelligent have a hazy notion that castings are chopped out of hunks of metal quarried in a mine. Strictly among ourselves I don't mind admitting that castings sometimes are produced in a condition that lends color to such a supposition. I worked for an old master mechanic one time whose favorite jibe on seeing one of these castings was: "What do you call that thing, semisteel or semistone?"

Therefore it is with a distinct feeling of pleasure that we listen to foreign visiting foundrymen describing foundry conditions and foundry practice in their own countries. We have had them from every European country, from North and South America, from Africa, Asia and Australia. They bring with them the pulsing atmosphere of their own lands. Cities that heretofore were as remote as the stars in heaven, teeming with life, clear cut and sharp as a view brought into the field of a powerful and accurately focused telescope. Prominent buildings are identified, crowds of people are seen hurrying to and fro on the streets and one almost can hear the hoots of the automobiles, the screaming siren of a fire truck and the rattle and bang of the ubiquitous trolley cars.

Castings are made in green sand, dry sand and loam molds. They are bedded in the floor, rolled over in flasks and made on the bench. Iron is melted in cupolas of all shapes and sizes, in air furnaces and in electric furnaces. Steel is melted in converters, openhearth furnaces, in crucibles and in electric furnaces. Nonferrous metals are melted in iron pots, in reverberatory furnaces, in open flame furnaces, in electric furnaces and in crucibles set in every conceivable heat producing medium from a blacksmith forge to a chamber utilizing electric current.

Up to the present I have not heard of any foundryman who has tried to utilize the sun's rays through a burning glass, but apparently every other form of fuel is in constant use. Crucible metal is melted with wood, charcoal, hard and soft coal, coke, oil, gas and electric current. I shall not be surprised some day to learn that some inventive genius has developed a method of generating sufficient heat through friction. In fact I have worked in places where enough hot air and friction was developed on occasion to melt all the metal in the shop if properly applied.

Bill came in the other night while my mind was running along in this groove and I happened to mention that we had been favored that morning with a visit from an English foundryman who has been located for several years in Johannesburg, South Africa. Among other items of interest he said he had spent a few years in this country in his younger days. When I told Bill that his name was T. R. Jackson he slapped his knee in surprise.

REAPPEARANCE BY SPECIAL REQUEST OF THE FOUNDRY MEXICAN WRESTLER

"Old Tom Jackson," he cried. "Why I worked with him in the old Frontier in Detroit back in, let's see, it must have been '98. I remember we were together one night up at the Fort street station when the troops came home from the Spanish war. We both left Detroit that winter and worked south by easy stages to New Orleans. In the spring I came north again but Tom shipped on a boat going to South Africa and I lost track of him. Is he still in town? I certainly should like to see him."

I told Bill his friend intended to remain for a few days and we arranged for a reunion for the following day.

"Its a funny thing," said Bill, "how you bump into fellows that way. The other day a fellow walked into the shop, a lad I had not seen for about 12 years. We had played a short engagement in one of the leading foundries in Denver and then had parted company. He started for the coast and I joined a select party of tourists who had secured reservations on the rods of a fast freight traveling East. Imagine my surprise when I learned that for several years he had been shop superintendent for a copper company in Chile and now is enjoying a six months leave of absence.

"My former conception of Chile was of a long, narrow country bearing about the same relation to the remander of the South American continent as the rind does to a healthy slice of watermelon. In a general way I had gathered that the entire coast line was a towering guano cliff where ships touched occasionally to scoop a few thousand tons into their holds and then departed for less favored countries. I was under the impression that all the people lived in four towns—Lima, Callao, Antofogasta and Iquique. Even at that I did not know if the *i* in Lima was as the *i* in Tim or in time. I was wrong on both counts. It is pronounced like the double *ee* in sheep. Out of the four I only had one right and that is the longest word in the list. Callao is *Cahyah*. Iquique, well Iquique is too deep for me. I can spell it but I can't say it. Also I was surprised to find that Lima and Callao are in Peru.

"With the exception of new machinery, the molders in this lad's shop make all the iron, steel and brass castings required for the operation of the mines and smelters and they have handled castings up to eight tons. The supervisory force is recruited principally from the United States, but all the workmen are natives, who are paid the munificent wage of 12 pesos per day, about 80 cents in United States currency. This lad told me they are equal to any molders he has seen elsewhere. The native foreman is a mechanical genius. He cannot speak English and he cannot read a blueprint in the orthodox manner, but he can get up rigging and devise methods for producing castings that would tax the skill of even the most elect. All he requires is a few free hand sketches and an occasional word in our hero's best Spanish.

"Those are the kind of shops," said Bill, "where molders develop into

real mechanics. They become accustomed to manipulating all kinds of metal and of devising impromptu methods and rigging for making the molds. Even in our ordinary iron jobbing shops the foundryman frequently is timid at accepting a job to be cast in some other metal. Sometimes he is asked to make a lead keel for a boat and he does not know whether or not the lead can be melted in the cupola or if a green sand mold will withstand the pressure.

"The melting temperature of lead is so low that it may be melted under practically any condition and in any kind of a device where heat may be applied. For example, it may be melted directly in the ladle with an oil torch. The ladle lining first is raised to a red heat as in steel foundry practice. The bottom then is covered with lead pigs and when they have melted, additional pigs are added until the necessary amount is melted to pour the casting. The torch of course is kept going constantly to melt each additional layer of pigs. This method is preferable to any other, because there is no waste of metal, the temperature can be controlled closely and the metal may be poured at a temperature not much higher than the melting point. If an oil torch is not available the ladle lining may be heated with a wood fire. The same fire afterward will serve to melt the metal and keep it hot.

A third method is to mount a salamander over the ladle. The ladle is dried thoroughly and heated with a wood fire. Then the pigs of lead are thrown into the coke fire in the salamander a few at a time. They melt almost immediately after they touch the fire and the metal trickles through into the ladle. A blast from an air hose under the grate of the salamander will brighten the fire wonderfully and hasten the melting of the metal. The wood fire in the ladle will keep the metal hot.

"The ordinary iron jobbing foundryman confronted with the job of making a fairly heavy lead casting, usually prefers to melt the metal in the cupola. Under certain circumstances he may make a complete lead heat, but usually the practice is to charge the lead after all the iron for the day has been poured. The bottom of the cupola is drained out clean, the blast is shut off, the tap hole is closed and the lead is charged through the charging door in the same manner as the usual charge of iron is handled. If the amount is not too great it may be held in the cupola until it is all melted. Otherwise a close watch is kept through one of the tuyeres and the metal is taken out in successive taps as it comes in sight. For fairly small quantities the tap hole is not closed. The ladle is placed under the spout with a good wood or charcoal fire in the bottom. The lead is thrown in through the charging door and runs out almost immediately in a liquid form through the tap hole. By fairly small quantities, is meant small in proportion to the size of the cupola. For example one ton bears almost the same relation to a 28-inch cupola that five tons does to a cupola 60 inches in diameter.

JUST SEVEN MILES FROM LAND—STRAIGHT DOWN

"Molten lead is much more penetrating than iron therefore it is advisable to examine the lining of the ladle after it has been dried. The cracks must be daubed, otherwise the metal will leak through to the shell and thence through the shell at any convenient opening. Some of the metal also will work into the crevices in the brickwork of the cupola and will appear in subsequent heats. A small quantity will not harm the iron. In fact it seems to make the iron more fluid and lively.

"Any kind of a sand mold, green, skindried or oven dried, if properly made, will serve to hold the metal. The sand is rammed harder than it would be for a similar casting in gray iron. Men accustomed to casting junky jobs in green sand will experience no trouble in handling this keel in green sand. If experience has shown that the sand must be skin dried or dried in the oven for heavy work, then by all means the mold for the keel should be dried. On account of the comparatively low temperature of molten lead the effect on the sand is not severe. It is advisable to pour the metal as *cold* as possible.

"If bolt holes are required, short pieces of steel pipe packed full of dried silica will form more satisfactory holes than any other kind of cores. By dried sand is meant *thoroughly* dried sand. The square socket at one end designed to receive the head of the bolts by which the keel is attached to the boat, is formed by a square core with a shaft one or two inches in length which fits up inside the pipe. If the keel is cast on its side, chaplets will be required to prevent the pipes from bending. If it is cast in the position it will occupy on the boat, the square core on the bottom and a print on the top will hold each pipe in place.

"Another method frequently practised in making chunky castings where weight is the only consideration and where the melting facilities are limited is to fill the greater part of the mold with pigs or with larger pieces of metal cast for the purpose. The remainder of the space then is filled with molten metal which fills the ouside and all the interstices and binds the contents in a compact mass. Lumps of metal used for this purpose are known colloquially as *Dutchmen*. "Reference to keels and boats and all that kind of thing," said Bill with a grin, "reminds me of the story of the colored member of the A. E. F. on his way across to take part in the doings somewhere in France. One night while passing through the dangerous submarine zone all hands were ordered on deck to take their places by the boats in the event of an attack. In the midst of the tense silence which prevailed, every man with his heart in his mouth and his nerves braced to withstand the bump that might send him into eternity, this burly colored gent inquired plaintively, 'Does anybody heah want to buy a good gold watch and chain?'"

Will Use Special Cars

The committee on transportation of the New England Foundrymen's association has arranged for special cars to carry the members to the American Foundrymen's convention at Detroit in September. These cars will be attached to the WOLVERINE, Boston & Albany railroad, leaving Boston Sunday Sept. 26 at 3:15 eastern standard time. R. F. Harrington, Hunt-Spiller Corp., Boston, is in charge of the arrangements.

The United States Electrical Tool Co., Cincinnati, has completed a new aluminum foundry at its Cincinnati works where it will make castings for its portable electric drills.

Surface Gages Necessary

For Certain Types of Accurate Work Done by the Patternmaker

By Walter C. Ewalt

AFTER studying the progress that has been made from the crude tools of our forefathers to the highly finished and nearly perfect instruments of today, one marvels at the ingenuity and resourcefulness of those who have gone before.

During a recent visit to the home of THE FOUNDRY, the writer saw many examples of artistic cast iron work made in Russia, Germany and other countries. Several years ago an article describing these masterpieces appeared in this magazine, but a few of the salient points will bear repetition for the benefit of those who did not see the article.

These works of art show practically every known method of molding and also include unknown compositions of iron. Not only are they made of extremely thin metal section, but the lines of ornamentation and the figures are perfect and distinct. However, one can imagine that in the production of this work in past years, time was not so much an object as it is today or countless numbers of men could be secured to do the work.

Nevertheless, as the years passed, mankind not becoming to any degree more skillful, did become, for want of a better word, more practical. This development has led to better tools, not because certain operations like measuring, making patterns, casting iron, etc., could not be done with the crude tools, but because they could be done more quickly,. with less men, and of course more accurate with the new order of things. For this reason mechanics constantly have been making improvements and inventing new tools.

One of these tools is the surface gage. Not so many years ago one could not be found in a wood patternmaker's kit. Today, in certain lines of patternmaking, they are a necessity. The surface gage, shown in Fig. 1, consists of a heavy base which may have a groove through the bottom so that it may be used on circular work as well as on flat surface. The base is provided with a pivoted spindle, which passes through a rotating head, which in turn passes through a bracket attached to the base. The bracket is adjustable to some degree, allowing the spindle to be moved for fine adjustments. The scriber is attached to the spindle by a snug head and clamp nut and this may be moved to any position. A hole is provided in the clamp next to the base in which the scriber may be used for light work or in low places. The spindle is removed when using it in this manner.

The base also is provided with two pins. When these pins are pushed below the bottom of the base the gage may be used as a stop and pushed along the edge of a board to make parallel lines. The scriber at one end comes to a straight point, while at the other end the point is bent over at an angle of about 90 degrees. From the points measurements are taken, parallel lines drawn, centers found, heights transferred, surfaces tested for parallelism, height gage, depth gage. The surface gage is used not only for vertical work, but for work on any angle. A number of these methods are shown in Figs. 2 to 13 inclusive.

At Fig. 2, the point of the scriber has been centered with the center of the recess boss, then withdrawn and measured with a scale. In Fig. 3, the measurements from *A* to *B* and *B* to *C* are desired. The point of the scriber is centered at *B* and the measurement made on the scale of a combination square. The end of the scale is even with the bottom of the stock and rests on the surface *A* and is found to be 1 3/16 inches. Now in Fig. 4, the scale is raised 3/16-inch from the surface *A* and clamped. This brings the point of the scriber shown in dotted lines to the 1 inch mark. The scriber then is raised to center on mark *C*, Fig. 3, and shown in dotted

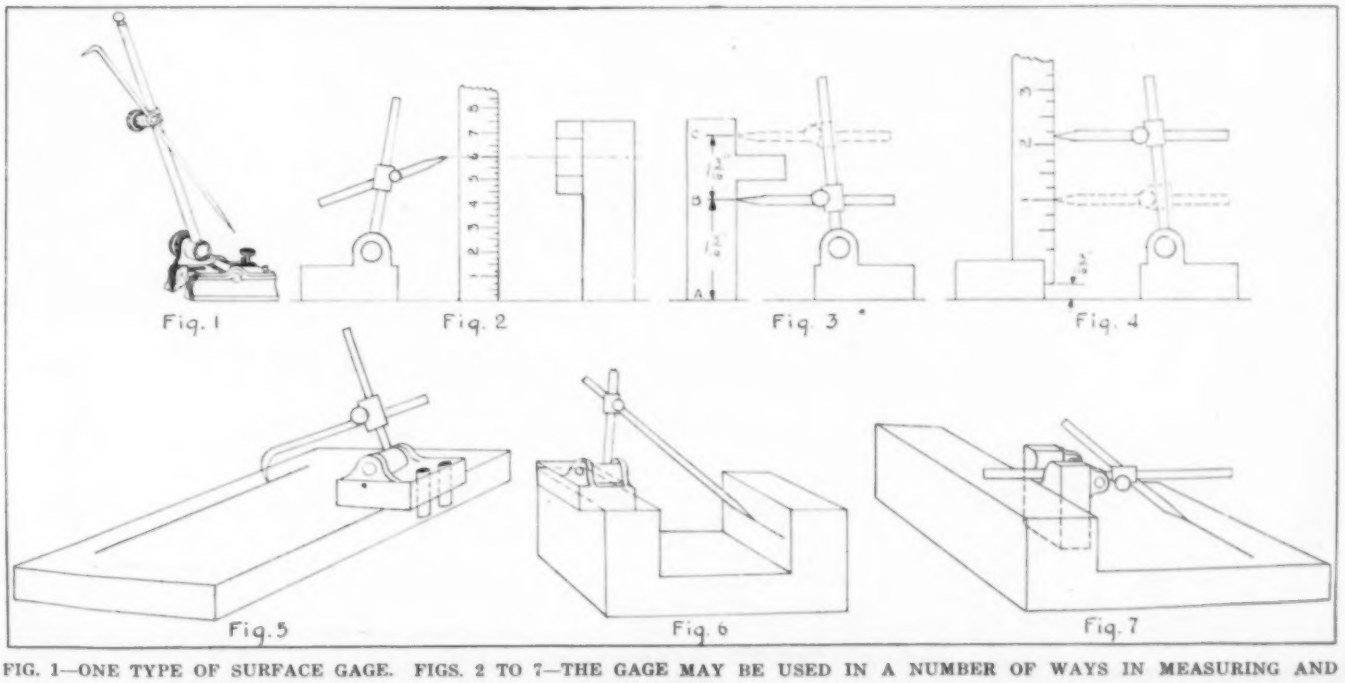
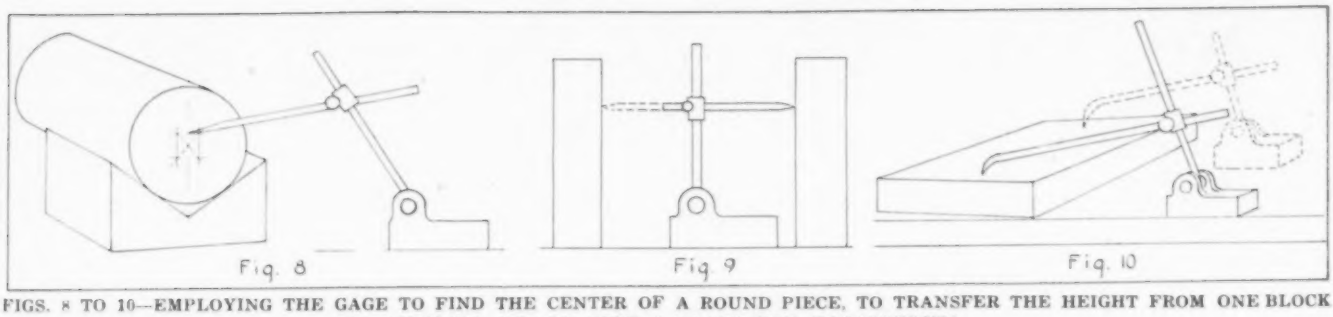


FIG. 1—ONE TYPE OF SURFACE GAGE. FIGS. 2 TO 7—THE GAGE MAY BE USED IN A NUMBER OF WAYS IN MEASURING AND MARKING



FIGS. 8 TO 10—EMPLOYING THE GAGE TO FIND THE CENTER OF A ROUND PIECE, TO TRANSFER THE HEIGHT FROM ONE BLOCK TO ANOTHER AND TO TEST A BLOCK FOR PARALLELISM

lines. When measured at Fig. 4 this shows 1 3/16 inches above the 1 inch mark or 1 3/16 inches from *B* to *C*, thus eliminating the addition of the fractions and arriving at the correct measurement much more rapidly. The method of drawing a parallel line with the two pins sliding against the edge of the board is shown in Fig. 5. Another application of parallel lines is illustrated in Fig. 6, while Fig. 7 shows still another application of parallel lines. Many other ways of arriving at the same results may be used.

The center of a round piece is found in Fig. 8 by scribing lines as shown. Two parallel lines are scribed and then two other parallel lines scribed square with the first set of lines and the corners connected. The center is the point where the diagonal lines intersect. Fig. 9 shows how the height is transferred from one block to another.

Fig. 10 indicates the method of testing the block *A* for parallelism by moving the bent point from end to end. At Fig. 11, the bent point is moved so it just touches the underside of the shoulder. By measuring from the surface to the tip of the point a height gage is made. In Fig. 12, the instrument may be used as a depth gage by lowering the point into the hole until it touches the bottom. The measurement is taken from the point to the bottom of the surface gage. In Fig. 13, the gage is carried around the smaller round pieces to test the perimeter of the larger circular pieces.

Other Gages Described

These illustrations show some of the most common operations which may be accomplished with the surface gage, owing to the ease of adjusting the gage, the patternmaker finds this tool essential in operations of a similar nature. A surface gage with a base 3½ inches and spindle 12 inches and 18 inches long is suitable for a wood patternmaker.

Another gage which will be found extremely useful is shown in Fig. 14. The body *D* is made of aluminum and the beam and pin are steel. This combination gage may be used as a marking gage as the roller at *A* is sharp edged and made of hardened steel. This combination makes the tool for gaging across the grain, with the grain or on an end grain of wood. The body *B* is about 7 inches long and may be used upon flat, concave or convex surfaces. The flat end of the beam at *C* may be used as a depth gage and the other end of the beam at *D* has the pin projecting through it making a suitable gaging tool, over and beyond ribs, etc. A scriber point is located at the end of the body, *E*. The point of the scriber is flush or in line with the face of the body. When used with the aid of a square edged board, the point scribes lines across uneven surfaces, coreboxes, etc., an example being shown in Fig. 15. This part of the gage often is made by the worker by driving a nail in the end of a flat board and filing it sharp and flush with the surface of the board.

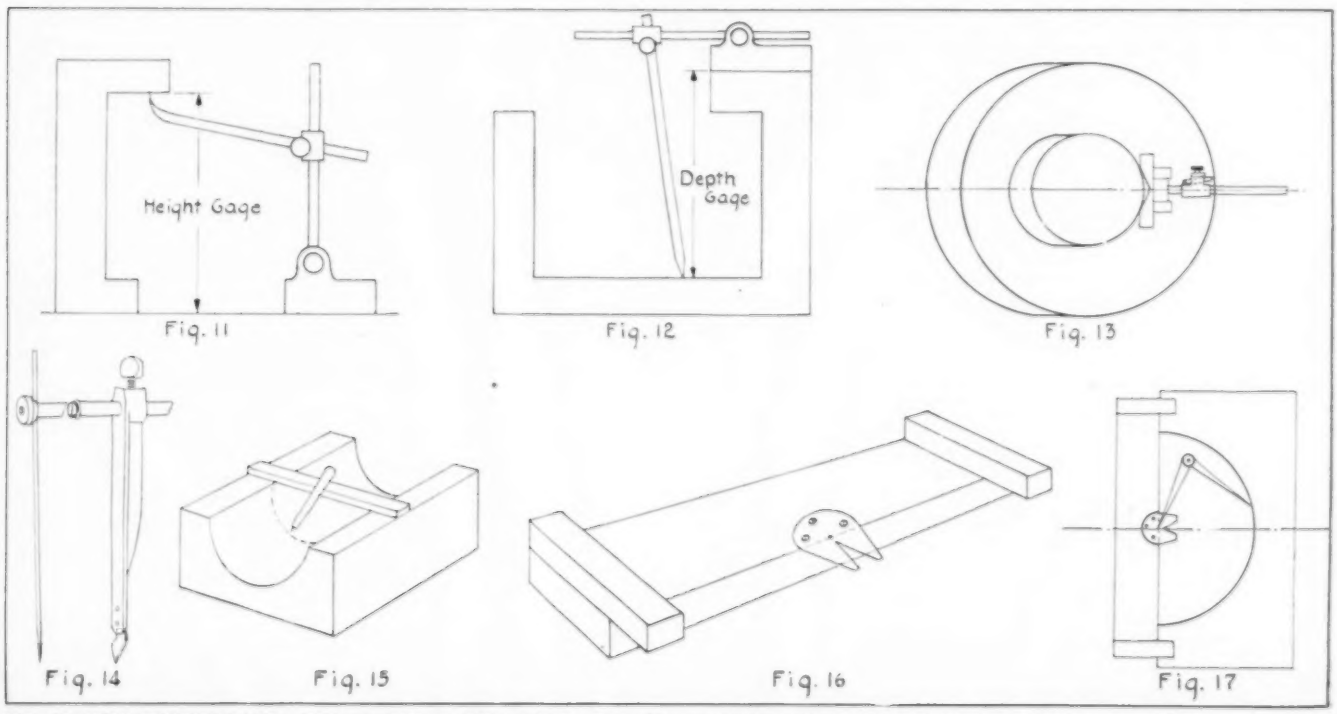


FIG. 11—THE HEIGHT GAGE. FIG. 12—THE DEPTH GAGE. FIG. 13—TESTING THE PERIMETERS OF CIRCULAR PIECES. FIG. 14—A COMBINATION GAGE. FIG. 15—MARKING WITH THE COMBINATION GAGE. FIG. 16—A CENTER FOR DIVIDERS. FIG. 17—USING THE CENTER

Another home made tool is a center for dividers shown in Fig. 16. It consists of a strip of wood with two adjustable projecting pieces at each end. A piece of thin brass or sheet iron is fastened in the center, while a small hole is drilled directly over the edge to contain one leg of the dividers. This not only gives a center for the circle shown in Fig. 17, but circles may be made at any edge of a board.

Propose Specifications for Facings

PROPOSED master specifications for foundry facing and silica flour for foundry use recently have been sent by the federal specification board of the United States navy department, Navy Yard, Washington, to several interested technical associations for their consideration and criticism. The technical data in the specifications were compiled from existing departmental specifications with test data taken from inspection records of typical deliveries of several commodities. While no official action will be taken by the associations, it is believed that the criticism will enable the board to provide a set of specifications in keeping with commercial practice. The proposed specifications are as follows:

SPECIFICATION FOR FOUNDRY FACING

Grade: 1. This specification covers five grades of foundry facing as shown in paragraph 4.

Material: 2. The manufacturer is given wide latitude in the selection of raw materials and processes of manufacture, so that he may furnish products of the highest quality.

General Requirements: 3. All material covered by this specification excepting grade five are to be for general use in iron and brass foundry work for coating the face of sand molds either in dry or wet form.

Detail Requirements: 4. A. Foundry facing shall conform to the requirements shown in Table I.

B. Grade 1, ceylon graphite foundry facing to be of the best grade of foliated graphite, finely ground, for use on green sand molds, material to be of such quality that it may be applied to damp sections of mold without causing tearing of the sand.

C. Grade 2, foundry blacking shall be suitable for mixing to form a wet wash for coating exceptional heavy dry sand molds such as cast iron rolls, ingot molds, etc.

D. Grade 3, silver lead foundry facing shall consist of finely powdered graphite, free from coal dust or other forms of monographitic carbon.

E. Grade 4, charcoal foundry facing shall consist of finely powdered charcoal, free from coal dust or other forms of carbon. The earthy matter, or ash, shall be fine, smooth, and free from grit.

F. Grade 5, sea coal or bituminous foundry facing shall consist of finely powdered coal dust and be of such consistency as to permit its use on simple green sand molds or of its being compounded into facing mixtures.

Methods of Inspection and Tests: 5. Container shall be opened at random and samples taken and tested to ascertain that the material conforms to the requirements of this specification.

Packing and Marking: 6. Unless otherwise required by the contract or purchase order, material shall be delivered in strong, tight, well-coopered barrels of about 500 pounds, net weight. Each container shall be plainly marked with the contract or purchase order number, name of manufacturer, the material, net weight and grade.

Additional Information: 7. A. Contracts and purchase orders should state what grade of material is required.

B. When submitting bids, bidders shall furnish a two-pound sample of the facing they propose to furnish. Such samples shall be furnished in a neat tin plate box and shall have the name of the manufacturer or contractor and the grade of the material as designated in this specification distinctly marked thereon.

General Specifications: 8. General specifications for federal specification board specification No. —— in effect on date of issuance of proposal, shall form part of this specification.

SPECIFICATION FOR SILICA MOLD WASH

Grade: 1. This specification covers two grades of silica mold wash as shown in paragraph 4.

Material: 2. The manufacturer is given wide latitude in the selection of raw materials and processes of manufacture, so that he may furnish products of the highest quality.

General Requirements: 3. A. Both grades of material covered by this specification shall be suitable for use in steel foundry work by mixing with water or binder mixture for washing the surface of sand molds.

Detail Requirements: 4. A. Silica mold wash shall conform to the requirements shown in Table II.

B. Grade 1, silica mold wash shall be a pure silica flour, very finely powdered and air floated to remove such particles as will separate in water emulsion.

C. Grade 2, silica mold wash shall be suitable in every respect as a steel mold wash but can be made use of when a wash of a less pure silica content is all that is required.

Methods of Inspection and Tests: 5. A. Containers shall be opened at random and samples taken and tested to ascertain that the material conforms to the requirements of this specification.

B. Sediment shall be determined by placing a 5-gram portion of the sample in a 100-cubic centimeter graduated comparison tube and the volume brought to 100 cubic centimeters by the addition of cold water. After thorough agitation and mixing, no more than 1 cubic centimeter of sediment shall settle to the bottom of the tube in 10 minutes.

Packing and Marking: 6. Unless otherwise required by the contract or purchase order, material shall be de-

TABLE II

Silica Mold Wash Requirements

Grade	Per cent to pass a 100 mesh sieve	Per cent to pass a 200 mesh sieve	Per cent Si 02 minimum	CC of sediment 10 minutes after agitation. Maximum
1	....	100	99	1
2	100	90	98.5	....

TABLE I

Requirements for Foundry Facings

Requirements for Foundry Facings

Grade	Per cent to pass a 60 mesh sieve	Per cent to pass a 75 mesh sieve	Per cent to pass a 100 mesh sieve	Per cent to pass a 200 mesh sieve	Per cent Volatile matter maximum	Per cent Fixed Carbon minimum	Per cent Ash maximum	Per cent Graphitic carbon
1	....	....	90	85	....	....	....	90 (a)
2	100	....	....	....	....	....	35	
3	....	100	98	75	5	....	45	55 (b)
4	....	100	75	....	....	....	....	.....
5	....	....	40	25	(a) 20 (b) 40	55 (a)	10	.....

(a) minimum.
(b) maximum.

livered in strong tight, well-coopered barrels of about 500 pounds net weight. Each container shall be plainly marked with the contract or purchase order number, name of manufacturer, the material, net weight and grade.

Additional Information: 7. A. Contracts and purchase orders shall state what grade of material is required.

B. When submitting bids, bidders shall furnish a two-pound sample of the silica mold wash they propose to furnish. Such samples shall be furnished in a neat tin-plate box and shall have the name of the manufacturer or contractor as designated in this specification distinctly marked thereon.

General Specifications: 8. General specification for federal specification board specification No. —— in effect on date of issuance of proposal, shall form part of this specification.

Statistics on Operation Of Small Cupola

Question: We are not satisfied with present melting conditions and will appreciate your advice on how and what to melt for a 4000-pound heat of gray iron to be poured into miscellaneous jobbing castings. We should like to have figures on the diameter of the cupola best suited for the purpose, number and size of tuyeres, and the most suitable blast pressure. We have gas coke, hard coke, pig iron, scrap iron and scrap steel and we want to know the proper proportion in which to mix them. Finally what weight of iron should we anticipate in good castings, in bad castings, in scrap, sprue and furnace loss.

Answer: A cupola 28 inches diameter inside the lining at the tuyeres probably will be found the most convenient for your purpose. It will melt your entire heat in about one hour. If you are running a heat every day you will have a sufficient number of men in the shop to handle the metal as fast as it is melted. If you are only casting on alternate days and if you have a considerable quantity of small castings to pour, it might be advisable to employ a smaller cupola and extend the melting time over a longer period to meet the requirements of a smaller number of men. For illustration we will assume that a 28-inch cupola is employed. Six tuyeres 4 x 8 inches located about 10 inches above the sand bed will serve. The object in placing the tuyeres at this height is to provide a well for the collection and mixing of the metal before it is tapped. In this connection also it is well to provide a 500-pound mixing ladle in front of the spout instead of tapping directly into either hand or bull ladles. Provided your blower is capable of delivering approximately 1000 cubic feet of air per minute, the blast pressure may vary between 6 and 10 ounces. The lower you can keep the pressure, the better. A high blast has a tendency to produce hard castings.

A comparatively wide latitude is possible in making up the charge depending on many local factors. An average charge may be made up as follows: 400 pounds hard coke on the bed, followed by a 500-pound charge of iron containing 5 per cent steel, 25 pounds; 50 per cent pig iron, 250 pounds; 45 per cent scrap, 200 pounds. These are placed on top of the bed coke in the order indicated. The remainder of the charge is made up of alternate layers of coke and iron in the proportion of 50 pounds of coke to 500 pounds of iron. The coke may be mixed half hard coke and half gas coke. The foregoing mixture of iron is not arbitrary. If the silicon content of the pig iron is in the vicinity of 2.50 or 2.75 per cent the iron will be suitable for the general run of small castings that require subsequent machining. For larger castings, or castings that require no machining, the percentage of steel and iron scrap may be increased.

In the ordinary small jobbing shop the weight of good castings in proportion to the weight of the metal charged is approximately 80 per cent. The remaining 20 per cent is represented by gates and scrap 10 per cent; furnace loss 5 per cent; left over and lost in the drop 5 per cent.

Faked Foundry Facts

A Two Man Job

Belts To Resist Heat

Question: Can you tell us what kind of a belt will stand the most heat on a blower located close to the cupola?

Answer: Belt manufacturers who supply equipment for conveyor installations where the service is extremely heavy owing to the character or heat of the material, have developed belts that give satisfactory service. To a remarkable degree these belts resist corrosion, abrasion and heat, but we do not know of any fan belts designed to meet conditions of that character. Possibly on request a belt maker would fabricate a special belt to your order, but we fail to understand why such a belt should be necessary. Under normal operating conditions a fan belt is not exposed to a harmful temperature. If your blower is located so close to the cupola that the heat from the drop or from the slag spout affects the belt a remedy easily is applied. You either may extend the blast pipe and move the fan away from the cupola, or, you may leave the fan where it is and enclose the belt for a short distance in a sheet steel guard to protect it from the direct action of the heat.

Iron for Ingot Molds

Question: Will you kindly tell me the best iron mixture for steel mill ingot molds varying in thickness from 2½ to 4 inches and from 2000 to 6000 pounds in weight?

Answer: The great bulk of the ingot molds made in this country are poured from direct metal, that is metal taken directly from the blast furnaces and reduced from a bessemer ore. A considerable tonnage also is poured from cupola melted metal, but the iron used is the same bessemer iron of the following approximate analyses: Silicon, 1.00 per cent; manganese 0.80 per cent; sulphur 0.05 per cent; phosphorus 0.20 per cent and total carbon 3.75 per cent. Many other combinations have been tried at various times, but none has been found equal to the straight bessemer pig iron either direct from the blast furnace or remelted from the cupola. The molds must be fairly strong to resist comparatively rough usage, but the principal characteristic is the ability to resist alternate expansion and contraction over an

extended period. The phosphorus given may be regarded as the limit and only will be present in cupola melted metal. Phosphorus in direct metal usually is much lower. Where acid open-hearth furnaces are used the phosphorus in the molds must be held to a minimum, because the scrapped molds are charged into the furnaces. However, since the majority of the mills melt steel in the basic furnace, the phosphorus specification is not too rigid. For an altogether different reason, the foundryman holds the phosphorus below 0.20 per cent. Experience has shown that molds with a higher phosphorus content crack easily in service. The phosphorus may be only one of several contributing factors, but it is important.

Cast Iron Tested Quickly

THERE is a need for a quick method of testing the iron before pouring. Quality examination according to appearance of the fracture of a test bar or the depth of hardening in a larger test piece cast into a chill mold takes too much time. The iron cannot be kept in the ladle until the test pieces have cooled down. P. Wolf in *Stahl und Eisen*, states that the quality of an iron can be judged best by examining the fracture of a wedge shaped as

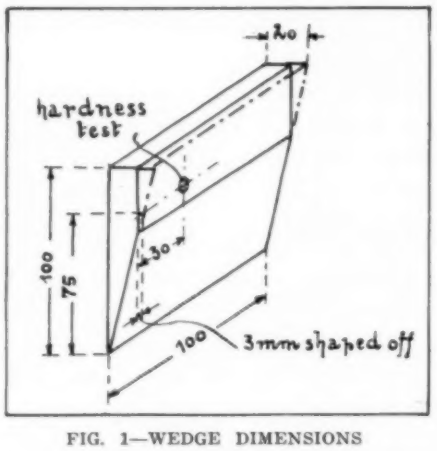


FIG. 1—WEDGE DIMENSIONS

in Fig. 1. Factors entering in are the depth of hardening from the point and the gradual or sharp merging of the white and gray textures. To have reliable results the wedges must be cast under the same conditions of moisture and permeability of molding sand, and temperature of the iron. The trustworthiness of the wedge test was checked by the Brinell and Shore hardness tests as it is believed that these tests are a better measure of the quality than the tensile strength.

Experiments were made with the following types of cast iron:

Ordinary machine casting, special cast iron I with high strength, special cast iron II for high temperature work, special cast iron III especially hard. The analyses of these irons are given in Table I. Test results were combined according to the following principles:

For each quality of iron, those experiments in which the values of

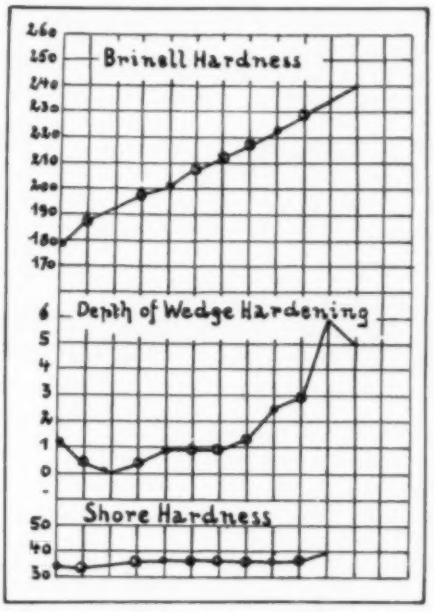


FIG. 2—PLOTTED VALUES OF VARIOUS HARDNESS TESTS

wedge hardening, brinell, and Shore hardness decreased or increased equally with regard to the preceding values, were summarized. The results are given in Table II. The machine casting shows the worst values. This comes from the fact that a negative value of wedge hardening cannot occur. Therefore all the values which are below the point where the hardening of the wedge ceases come off although the hardness test does consider the soft texture of the machine casting. The special cast irons, II and III, show the best results, which proves the importance of an exact charge of special pig iron without any iron of unknown origin.

The best values were plotted on the supposition that the brinell hardness is the best measure of quality. The average values of the hardening depth and the Shore hardness were plotted vertically below the corresponding brinell value. Fig. 2 is the diagram for the machine casting. The circles are average values of at least 60 samples, and the points, those of 30 samples.

$$k_s = \frac{H - 40}{6}$$

Since H equals the brinell hardness, it is possible approximately to calculate the tensile strength.

Molding Sand Production Decreases

Molding sand production in 1924 decreased 21 per cent below that produced in 1923. In 1924 a total of 4,403,893 tons of sand, valued at $4,995,268 was sold according to a report from the department of commerce The average value of the sand was $1.13 a ton. Ohio, the leading producer, supplied 917,733 tons valued at $1,206,501. Six states, namely Ohio, Illinois, New York, Indiana, New Jersey and Michigan in the order named, produced 91 per cent of the molding sand produced in the United States.

Appointed Agent

The Kuhlman Electric Co., Bay City, Mich., has appointed the Continental Sales & Engineering Co., 839 Oliver building, Pittsburgh, as district representative in Pittsburgh. E. J. Hughes is manager of the Continental company.

TABLE I

Analyses of the Irons Used

	Carbon	Silicon	Manganese	Phosphorus	Sulphur
1	3.5	2.15	0.75	0.8	0.1
2	3.4	1.7	0.8	0.5	0.09
3	3.4	1.4	0.45	0.2	0.09
4	3.3	1.2	1.1	0.4	0.08

TABLE II

Comparsion of Agreement Between Hardness Tests

	Brinell, Shore Wedge	Brinell, Shore	Brinell, Wedge	Shore, Wedge	Brinell, Shore Wedge different
	%	%	%	%	%
Machine cast	28.6	30.0	15.3	11.8	14.3
Special Iron I	30.0	22.7	16.8	15.5	15.0
Special Iron II	38.2	20.6	15.7	10.9	14.6
Special Iron III	47.0	14.7	11.8	14.7	11.8

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor
CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Stars and Steel Move Westward

AUTHORITIES may differ on whether Bishop Berkeley used the word *course* or *star* in the famous lines handed down from generation to generation of correspondents and spell binders: "Westward the Course (Star) of Empire Holds Its Way," but no person however slightly acquainted with history will quibble with the learned author over the accuracy of the statement. The opinion was written 200 years ago and is remarkable not so much as a summing up of what went before, as a prophecy of what has taken place to a remarkable extent since the Bishop laid down his mitre and severed his connection with the activities of his fellow men. The star of empire was definitely halted on the eastern brink of the Atlantic ocean at the time the lines were written in the year of grace 1700 A. D. Once the crossing was effected, it has blazed with increasing brilliance from decade to decade in this the latest and greatest of its many resting places. Who can say how many centuries will elapse before it crosses the Pacific to where it first shone over the cradle of the human race and lured the primitive tribes westward over the passes in the fanatical trains of Ghengis Khan and Tamerlane?

RECENT establishment in the Middle West of a new foundry for the exclusive production of ingot molds would seem to indicate an expansion in the steel industry, but not necessarily any decided westward shift of the star of empire. Foundrymen who are inclined to view the past with regret, the present with apprehension and the future with jaundiced eye should derive encouragement from this hearty token of increase in the production of steel. Castings enter extensively into every feature of the steel business. Owing to the enormous tonnage of materials handled and the rough character of most of the processes, the life of castings is comparatively short. For example the average life of an ingot mold is 150 heats. Then, it is thrown on the scrap pile. While it is true that all castings used in the steel industry do not pass out of the picture as rapidly as ingot molds, still the replacement program is extensive enough to keep a large foundry busy at every steel plant, and hundreds of miscellaneous foundries throughout the country depend for orders either directly or indirectly on the plants where steel is fabricated.

According to statistics compiled from reliable sources the per capita consumption of iron and steel in this country now is 800 pounds per annum as compared with a consumption on the same basis 50 years ago of 200 pounds. What is more important it still is going up. Demand for castings necessarily rises with the extension of the market for steel and steel products. If the foundryman instead of giving them away will insist on getting a fair price for his castings he will find the years to come will continue to reflect the beneficient rays of the star of empire.

¶ Big Fellows Produce Cheaper

MANUFACTURING concerns with an annual output valued in excess of a million dollars a year, according to the national industrial conference board, utilize labor much more efficiently than do the smaller firms. During the year 1923, the large plants above the million dollar yearly output, showed a production of $1481 per workman, compared with $1000 per capital from the workers in plants with annual sales above $500,000. In the class doing from $20,000 to $100,000 annual business, in 1923, the production per man was $825.

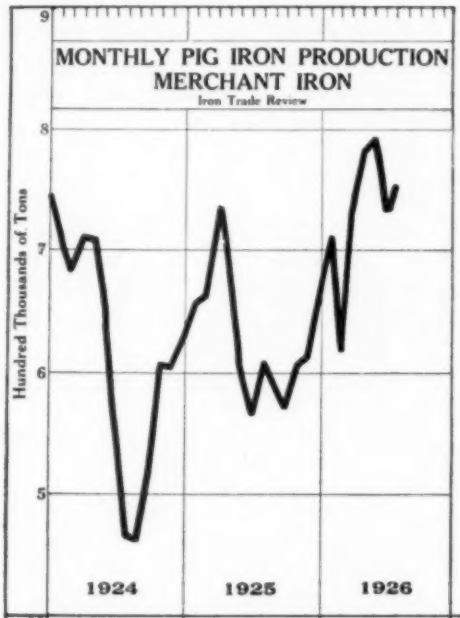
INCREASED efficiency may be ascribed to a number of factors, including superior equipment duplication of product, and perhaps better management in the large institutions and a complete analysis might not show much of benefit to the smaller plants. Perhaps all of the classifications mentioned by way of illustration might be found to have attained a high state of efficiency in using their labor. One fact, capable of direct application to many foundries, plainly is evident. The big fellow has the edge on competition in one important factor of castings cost, labor efficiency. Therefore, a price cutting contest with such a handicap usually proves unpleasant.

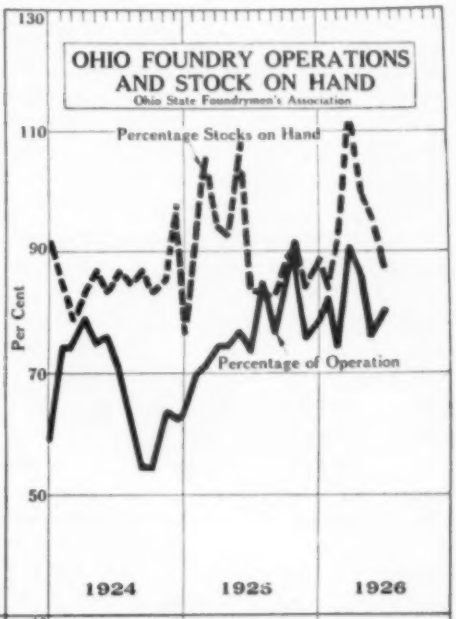
Trade Trends in Tabloid

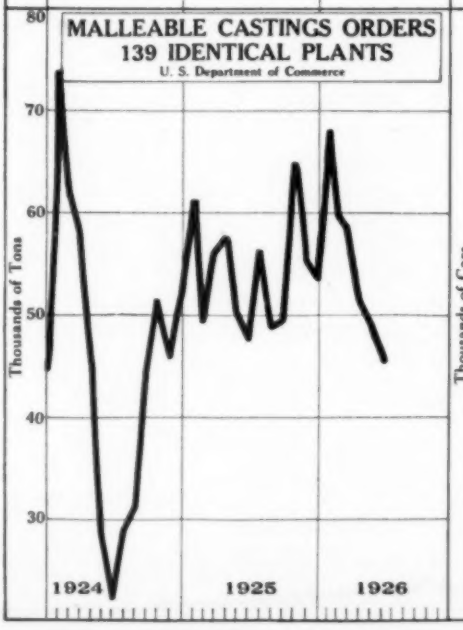
PRODUCTION in practically all lines has held up well through the summer. Building construction is active and the last week in July showed an increase over the preceding week and the corresponding seven-day period in 1925. Railroad buying again has slumped, the car orders for July showing in round number 1200. A number of car builders have practically suspended operations. However, freight car loadings continue at a peak, the week of July 24 establishing a new high record of 1,085,450 cars. Employment figures indicate general manufacturing activity is well ahead of 1925. Automobile production for July is estimated to be slightly ahead of June. Pig iron production in July was slightly below June, according to statistics compiled by the *Iron Trade Review*. The total for July was 3,223,964 tons, compared with 3,232,478 for the previous month. Merchant iron output increased from 734,823 in June to 750,388 tons in July. Average daily prices on nonferrous metals for July, according to New York quotations in the *Daily Metal Trade* follow: Casting copper, 13.614c; electrolytic copper, 14.171c; Straits tin, 63.095c; lead, 8.571c; antimony, 14.559c; aluminum 98 to 99 per cent, 27.00c and zinc, 7.427c, E. St. Louis, Ill. Jobbing foundry operations in the East range from 50 to 60 per cent of capacity, while specialty shops are working slightly in advance of this rate.

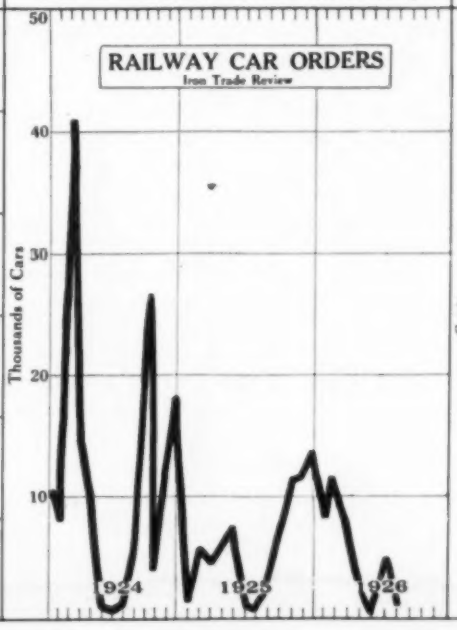
RAW MATERIAL PRICES
Aug. 6, 1926

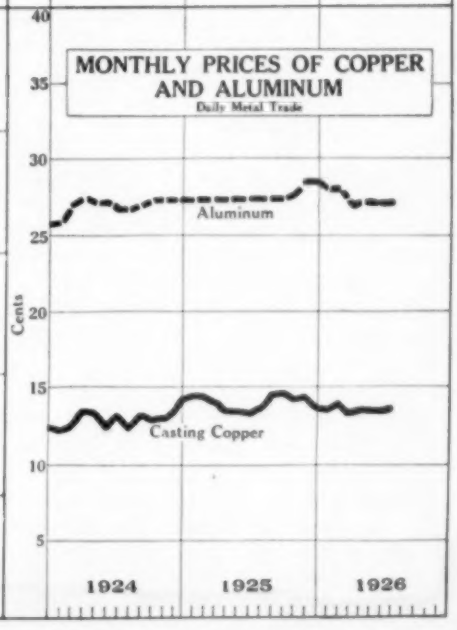
Iron	
No. 2 foundry, Valley	$17.00 to 18.00
No. 2 southern Birmingham	20.50 to 21.00
No. 2 foundry, Chicago	21.00
No. 2 foundry, Philadelphia	21.26 to 21.76
No. 2 foundry, Buffalo	20.00
Basic, Valley	17.50 to 18.00
Basic, Buffalo	19.00
Malleable, Chicago	21.00
Malleable, Buffalo	20.00
Coke	
Connellsville foundry, coke	4.00 to 4.50
Wise County foundry, coke	4.25 to 5.50
Scrap	
Heavy melting steel, Valley	16.00 to 16.25
Heavy melting steel, Pittsburgh	17.00 to 17.50
Heavy melting steel, Chicago	14.00 to 14.50
Stove plate, Chicago	14.25 to 14.75
No. 1 cast, New York	12.50 to 13.50
No. 1 cast, Chicago	17.00 to 17.50
No. 1 cast, Philadelphia	17.75 to 18.25
No. 1 cast, Pittsburgh	16.50 to 16.75
No. 1 cast, Birmingham	16.50 to 17.00
No. 1 cast, Buffalo	16.00 to 16.50
Car wheels, iron, Pittsburgh	16.50 to 17.00
Car wheels, iron, Chicago	16.50 to 17.00
Railroad malleable, Chicago	17.50 to 18.00
Agricultural, mail, Chicago	15.25 to 15.75
Malleable, Buffalo	16.50 to 17.00
Railroad Malleable Pitts	18.00 to 18.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	14.00
Electro copper, producers	14.50
Straits tin	65.25 to 65.37½
Lead, New York	9.00 to 9.10
Antimony, New York	15.75 to 16.00
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	26.50
Aluminum, No. 12, remelt	22.50 to 23.00
Zinc, E. St. Louis, Ill.	7.40 to 7.42½











Personal

Robert J. Anderson, consulting metallurgist, Cleveland, has returned from a two-months' trip to the Pacific coast.

S. A. Andrew, proprietor of the old firm of Fisher & Norris Co., operating at the Eagle Anvil Works, Trenton, N. J., is spending the summer at Villa Carlotta, Lake Como, Italy.

W. A. Riddell has been appointed to succeed E. H. Haslam as general manager of the Hadfield-Penfield Steel Co., Bucyrus, O. Mr. Haslam has retired after three years' service in that capacity.

J. W. Dixon Jr., formerly connected with the Chain Belt Co., Milwaukee, has accepted a position with the Western Foundry Co., Chicago. Mr. Dixon served as a battery commander during the world war.

Harry Noble is now foreman at the Hoyt Metal Co., Toronto, Ont. Mr. Noble was foundry foreman with the Architectural Bronze & Iron Works, Toronto, for 7 years, and then foreman with the Robert Mitchell Co., Montreal, Que., for a year.

Dr. H. W. Gillett, bureau of standards, Washington, will be chairman of the symposium on "Material for Extreme Conditions in the Electrochemical Industrial," at the fall meeting of the American Electrochemical society to be held at Washington, D. C., Oct 7, 8 and 9.

Marcel Paul has been elected chairman of the Hauts Fourneaux et Fonderies de Pont-a-Mousson, France, to succeed Camille Cavallier whose death was announced in the Aug. 1 issue of THE FOUNDRY. Mr. Paul studied engineering at the Ecole Polytechnique, Paris, and has been managing director of the firm since 1917.

Papers To Be Presented

The following papers will be submitted at the autumn meeting of the British Iron and Steel institute which is to be held, by invitation of the board of directors of Jernkontoret, at Stockholm, Sweden, on Aug. 27 and 28. "The Effect of Nitrogen on Chromium and Some Iron-Chromium Alloys" (Alloys of Iron Research, part IV) by F. Adcock; "A Physical Investigation into the Cause of Temper Brittleness" by J. H. Andrew and H. A. Dickie; "Anomalies in Heat Conduction, with Some Determinations of Thermal Conductivity in Iron and Carbon Steels" by C. Benedicks, H. Backstrom and P. Sederholm; "Electrochemical Potentials of Carbon and Chromium Steel" by C. Benedicks and R. Sundberg; "The Treatment of Steel with Ferro Carbon-Titanium" by G. F. Comstock; "The Mechanical Properties of Four Heat-Treated Spring Steels" by G. A. Hankins, D. Hanson and Miss G. W. Ford; "Is the Direct Change from Austenite to Troostite Possible?" by K. Honda; "The Carburization and Decarburization of Iron and Some Investigations on the Surface Decarburization of Steel" by A. Johansson and R. Von Seth; "The Development of the Swedish Iron and Steel Industry During the Last 30 Years" by A. Johansson and A. Wahlberg; "Notes on Jernkontoret" by E. Kinander; "The Testing of Hardened Steel" by A. Lundgren; "Notes on the Development of the Swedish Mining Industry During the Last 25 years"; "The Constitution of the Iron-Silicon Alloys" by G. Phragmen.

Year Book Is Published

The American Engineering Standards committee recently has published its year book for 1926. More than 200 definite standardization projects are in process or completed under the direction of this committee, and 365 national trade associations, technical societies and government bureaus are co-operating in the work through some 1600 representatives. The membership of the American Engineering Standards committee now consists of 19 national trade associations, nine national technical societies and seven government departments. Charles E. Skinner, assistant director of engineering, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is chairman; Charles R. Harte, construction engineer, Connecticut Co., New Haven, Conn., is vice chairman. The advisory committee is composed of, J. A. Farrell, president, United States Steel Corp.; George B. Cortelyou, president, Consolidated Gas Co. of New York; J. W. Lieb, vice president, New York Edison Co.; L. F. Loree, president, Delaware & Hudson Co., and Gerald Swope, president, General Electric Co.

Copies of the year book may be had upon application to the office of the American Engineering Standards committee, 29 West 39th street, New York.

W. B. Wallis, president of the Pittsburgh Electric Furnace Co., Pittsburgh, recently has returned from a two months' trip in Europe. He visited Sweden, France and Germany.

Obituary

Harry F. Schenk, vice president of the Foran Foundry & Mfg. Co., Flemington, N. J., died in that city recently.

Henry Smith, assistant superintendent, Collingwood Shipbuilding Co., Kingston, Ont., was drowned Aug. 1 while giving assistance to a stranded boat of the shipbuilding drydock.

William H. Hamilton, member of the board of directors of the Rosedale Foundry & Machine Co., Pittsburgh, died at his home in that city on July 18. He was 68 years old.

William B. Brayton, 54, former secretary and treasurer of the Standard Car Wheel Co., Cleveland, died recently in Buffalo. He was the son of Charles A. Brayton who founded the Mahr & Brayton Foundry Co., which later became the Standard Car Wheel Co.

Thomas B. Alcock, who for 50 years has been connected with the Gurney Foundry Co., Toronto, Ont., died recently. He entered the employ of the Gurney foundry at the age of 13 years, and during his 50 years of service, he held various positions including the office of secretary.

George H. Boyd, wealthy philanthropist of Sharon, Pa., died at Sring Lake, N. J., Aug. 1 of acute indigestion. He was 68 years old. Born in Elyria, O., in 1858, he removed to Cleveland when a young man and engaged in the iron trade. He was one of the organizers of the Valley Mould & Iron Corp., with works at Sharpsville, Pa.

Charles T. Wilson, traveling representative for William Sellers & Co. Inc., Philadelphia, died at his home in Haddonfield, N. J., recently at the age of 65. He had been connected with the Sellers company for 46 years, having started with that organization in 1880. Mr. Wilson worked in the shops until 1893 when he was made traveling representative.

Percey Stubbs, director of Joseph Stubbs Ltd., Ancoats, Manchester, England, died on July 7 after a short illness. He was the youngest son of the late Joseph Stubbs, founder of the firm. Mr. Stubbs, originally was trained in the foundry, but eventually was transferred to the commercial side of the business. He was the brother of Oliver Stubbs, past president of the Institute of British Foundrymen.

Air Drill Inventor Dies

Theodore P. Kimman, works manager, Cleveland plant, Chicago Pneumatic Tool Co., died at his home July 24, from heart disease. He was the inventor of the first four-piston air drill and was considered an authority on mechanics. He was associated with Edward N. Hurley, chairman of the shipping board, in the development of air drills. Mr. Kimman was superintendent of the Cleveland plant from 1903 to 1921 when he succeeded his brother, H. J. Kimman, as works manager.

Hold Midsummer Outing

The New England Foundrymen's association held its August outing at the Pomham club, Providence, R. I., Aug. 11. A luncheon was served at 12 o'clock and a shore dinner at 2 o'clock. An attractive entertainment and cabaret were enjoyed by those present.

Will Hold Convention

The annual convention of the Ohio State Foundrymens' association will be held at the Hotel Sinton, Cincinnati, on Sept. 16 and 17. Thursday morning Sept. 16 will be given over to registration and committee meetings. A noon luncheon will be served, followed by a program of talks and discussion. At 7 p. m. Thursday the annual banquet of the association will be held at the Hotel Sinton. On Friday the members will visit one of the prominent industrial plants of Cincinnati as guests of the Cincinnati foundrymen. Luncheon will be served at noon and the remainder of the business discussions will be be held. Immediately following this meeting, the directors for the ensuing three-year period and the officers for the next year will be elected.

Chinese Cook in Cast Iron Vessels

IN CHINA, cast iron is used extensively to make large shallow cooking pots or skillets. The manufacture of these pots was described in a series of articles on the art of founding in China that appeared recently in THE FOUNDRY. *Huchiatun, Anhwei province, has two iron foundries, each capitalized at $300,000 to $400,000 and employing about 300 men, engaged in the production of cast-iron pots. The output of these works supplies the markets of Kiangsu province which is on the Yellow sea on the east coast of China, and the adjoining province of Anhwei. These pots are made of a good quality of cast iron.*

Broken and cracked pots are mended by a class of itinerant repairers and made to prolong their usefulness in the kitchen until they can be repaired no longer. Scrapped pots are collected by peddlers who send them to the Anhwei manufacturers for recasting. Sometimes old pots can be exchanged for new ones of a smaller size.

The market price of new iron pots varies with the size of the vessel. One 2 feet in diameter and weighing about 6 catties or 8 pounds is sold for $1.10 wholesale by the Anhwei manufacturers and for $1.20 by the Nanking retail dealers. The manufacturers buy the scrapped pots at $4.70 to $4.80 a picul or 133 1/3 pounds. The peddlers obtain them for 4 cents a catty and can make a profit of 70 to 80 cents on every picul of scrapped pots.

A new establishment capitalized at $100,000 and employing 60 men was opened recently at Hansimen, Nanking. The men employed are highly skilled. Much care must be taken in the molding and pouring due to the extreme thinness of the walls of the pots.

Builds Laboratory

The American Foundry Equipment Co., Mishawaka, Ind., has constructed a foundry which will be used as a laboratory and demonstration plant for the process of permanent mold casting developed by H. A. Schwartz and associates and for the production of aluminum castings.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Institute of Technology, 3200 Federal street, Chicago; secretary-treasurer, E. C. BARRINGER, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary, WM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 265 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary, HOWARD EVANS, J. W. Paxson Co., Luzerne and D streets, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, WILLIAM K. FRANK, Damascus Bronze Co., South avenue, N. S. Pittsburgh; secretary-treasurer, WM. J. BRANDT, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. FIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

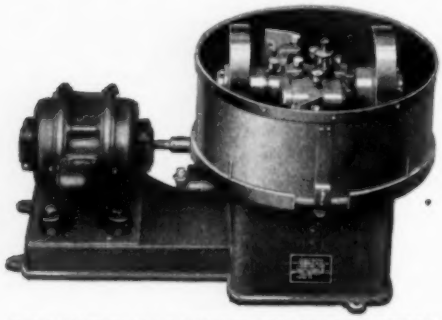
Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

Applies Sand Mixer to the Laboratory.

A laboratory size sand mixer of the muller type now is being marketed by the National Engineering Co., 549 West Washington boulevard, Chicago. The laboratory model is built along the same lines as the larger sand mixers manufactured by that company to prepare core, facing and backing sand in foundries.

As may be noted in the accompanying illustration, the mixer consists of two large wheels or mullers and a series of plows which revolve on the inside of a circular pan containing the sand. The wheels and plows are driven by an electric motor and the motor and pan are mounted on a special base. The machine is sold complete with the motor and weighs approximately 400 pounds. The machine will mix from 8 to 15 pounds of sand at a time. The device is constructed so that it may be taken apart and cleaned in a few minutes.



THE MIXER IS DRIVEN BY AN ELECTRIC MOTOR

Core Causes Porosity in the Piston Head

Question: We have been troubled with a honeycomb structure around the openings in a locomotive piston head 22 inches in diameter, 7 inches thick, with a lightening core that reduces the weight to 550 pounds. We use a mixture of 70 per cent No. 1 foundry pig iron, 30 per cent good machine scrap and melt the iron with a good grade of coke and therefore cannot understand why the casting should have this dirty blowholed appearance.

Answer: Your iron mixture is in no way responsible for your present trouble. However, you may be interested to know that the proportions of pig and scrap may be reversed and still produce satisfactory iron for these castings at a reduced cost. The porosity to which you refer is caused by the core. The gas does not escape freely through the proper channels. Provide an open perfectly dried porous core made exclusively from sharp sand bonded with a minimum of any good binder, linseed oil for choice, see that the vents through the teats are generous in size and connected properly with vents through the body of sand in the mold, and you will experience no further trouble.

If you examine your present core you will find one or more of the following conditions:

Molding sand mixed with the sharp sand to give it a *body*. A little extra binder added to compensate for lack of rods.

Core made from a proper mixture, but not perfectly dried.

Core properly made and dried, but with the teats smothered in paste in the prints.

We assume that the core is suspended from the cope by three or four small prints and that all the vent from the lightning core has to pass through these prints.

Batteries Not Required

A light and easily portable radiation type pyrometer is being manufactured by the Bowen Instrument Co., Leeds, England. The device weighs 25 ounces and is 7 inches long and 4⅜ inches in diameter. The instrument is self-contained and requires no batteries or other accessories. The body of the pyrometer is constructed of aluminum and has an axial extension of smaller diameter at each end. The object lens is mounted in the extension on the right of the cross sectional diagram, while the extension on the left carries the eyepiece. The lens focuses the image of the hot body on a blackened absorbing disk to which is soldered the hot junction of a small thermocouple. The whole is mounted in an evacuated glass bulb which protects the disk and thermocouple. The leads from the thermocouple are attached to a sensitive millivolt meter of the moving coil type mounted in the body of the instrument. A button release controls the movement of the needle over the scale. These pyrometers are calibrated for black body conditions by the manufacturer, but specially calibrated instruments will be supplied for measuring the temperatures of hot billets, ingots, castings, etc., when withdrawn from the furnace or black body condition.

New Crane Is Installed

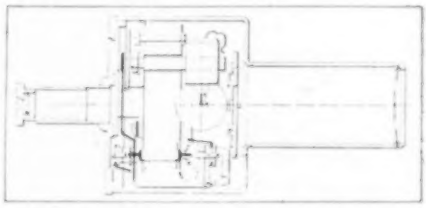
Farrell Foundry & Machine Co., Ansonia, Conn., recently closed its foundry to permit installation of a new crane and girders to insure safe handling of heavy rolls and castings. The crane weighs between 40 and 50 tons and some of the rolls and castings on which the concern is filling orders weigh between 110,000 and 115,000 pounds.

Appointments Are Made

The Harnishfeger Sales Corp., Milwaukee, has appointed H. S. Beale as sales engineer in the New York territory with offices at 50 Church street. H. A. Wolcott, formerly in charge of the Miami, Fla., office has been made district manager of New York. S. B. Bubier has been appointed sales engineer in charge of the Miami, Fla., district with offices at 343 S. W. River drive.

Fine Clay Bonds Sand

To meet the demand for a finely ground fireclay, the Illinois Clay Product Co., Joliet, Ill., has installed machinery to produce clay that will pass through 60-mesh or finer screens.



INSTRUMENT IS SELF-CONTAINED

This ground fireclay is supplied for the purpose of renewing or rebonding foundry molding sands. Claims for a reduction of casting losses and cleaning costs are made when this clay is used.

Company Changes Name

Mechanical Handling Systems, Inc., will be the new name of the Cecil R. Lambert Co., Inc., Detroit. This firm designs, manufactures and installs conveying and handling equipment. The plant and personnel will be increased, but there will be no change in ownership, management or executive staff.

Robert C. Nicholas and John W. Miller, who have been in charge of the Chicago office of Walter-Wallingford & Co., Cincinnati, pig iron sellers, have formed the firm of Nicholas & Miller. The new organization succeeded Walter-Wallingford & Co. in Chicago, taking over the headquarters at 1420 McCormick building and all of the accounts and producer representation.

Unusual Activity Continues

Summer Decline in Equipment Buying Has Not Been Extensive This Year When Compared With Previous Seasons—Inquiries Are Heavy

CONTRARY to the situation arising generally at this time of the year, considerable activity is noted in the market for foundry equipment. Although much of this interest has not as yet developed into orders placed, the amount of equipment being sold is ahead of the corresponding period a year ago and prospects are good for a heavier volume of sales in August than in the past month. Several manufacturers in Cleveland report an active list of inquiries, this being especially true among companies making sand handling and preparing equipment.

In Chicago territory, fewer inquiries for equipment have appeared since the first of the month, but prospective business indicated that August sales will approximate those in July, when activity was unusual for midsummer. Sales of sand preparing machinery have been in greater volume.

Eastern sellers report a fair inquiry for this season of the year, but relatively few orders. Most sellers report a falling off in business from two weeks ago. Inquiry is confined almost entirely to replacement business, as only a small amount of new construction is reported. Contracts recently have been let for doubling the capacity of the East Penn Foundry Co., Macungie, Pa.

Activity in the Pittsburgh area still is extensive as far as inquiries are concerned. These are particularly numerous for molding machines involving from one to six items at a time. The Bessemer Gas Engine Co., Grove City, Pa., is in the market for a mold drying oven and several cupola and core oven inquiries are out. While foundry activity is holding up well in New England, equipment buying has been slow during the past ten days.

CLEVELAND MARKET

Dust Arrester Equipment

Jacob Stove Works, Bridgeport, Ala., from the W. W. Sly Mfg. Co., Cleveland.

Molding Machines

Massillon Steel Casting Co., Massillon, O., one; from the Herman Pneumatic Tool Co., Zelienople, Pa.

Sand Preparing Equipment

Pratt & Letchworth, Buffalo; Detroit Steel Castings Co., Detroit; sand mixers from the National Engineering Co., Chicago.

Fremont Foundry Co., Fremont, O.; one sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., instead of the firing oven equipment from the Mayor Fuel Saving Furnace Co., Cleveland, as reported in the Aug. 1 issue.

Cadillac Motor Car Co., Detroit, one large batch sand mixer from the Standard Sand & Machine Co., Cleveland, through Falmer-Bee Co., Detroit.

Shakeout Equipment

Barnes Mfg. Co., Mansfield, O.; Ferro Machine & Foundry Co., Cleveland, shakeout bails; Dayton Steel Foundry Co., Dayton, O.; U. S. Radiator Corp., Detroit; Grabler Mfg. Co., Cleveland, vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

Jacob Stove Works, Bridgeport, Ala.; from the W. W. Sly Mfg. Co., Cleveland.

Miscellaneous

Wm. Powell Co., Cincinnati, complete mold and sand handling equipment from Lamson Co., Syracuse, N. Y. Installation designed by Lamson Co., engineers in conjunction with Fosdick & Hilmer, consulting engineers.

NEW YORK MARKET

Cranes

M. W. Kellogg Co., Jersey City, N. J., 5-ton electric crane; from the Milwaukee Electric Crane & Mfg. Co., Milwaukee.

Sand Preparing Equipment

Power Specialty Co., Dansville, N. Y.; sand mixer from the National Engineering Co., Chicago.

Shakeout Equipment

Kennedy Valve & Mfg. Co., Elmira, N. Y., shakeout bails; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

PITTSBURGH MARKET

Core Ovens

American Brake Shoe & Foundry Co., Pittsburgh, one car type oven from the Foundry Equipment Co., Cleveland, through Paul Hay, representative at Pittsburgh.

Cranes

Reliance Steel Casting Co., Pittsburgh, one 10-ton from Alfred Box & Co., Philadelphia.

Pittsburgh Malleable Iron Co., Pittsburgh, one used crane for new steel foundry.

Elliott Co., Jeannette, Pa., one crane.

Molding Machines

Eagan-Johnston Steel & Iron Co., Crum Lynn, Pa., two; Acme Steel Casting Co., Glassmere, Pa., one; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Preparing Equipment

Textile Machine Co., Reading, Pa.; Pittsburgh Steel Co., Monessen, Pa.; sand mixers from the National Engineering Co., Chicago.

Shakeout Equipment

Pittsburgh Plate Glass Co., Creighton, Pa., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co.

NEW ENGLAND MARKET

Cranes

Fairmount Foundry & Engineering Works, Woonsocket, R. I., one 5-ton electric hoist from the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Molding Machines

Malleable Iron Fittings Co., Branford, Conn., one jar squeezer; Eastern Malleable Iron Co., Naugatuck, Conn., one jar squeezer; Barbour-Stockwell Co., Cambridge, Mass., several jar squeezers and two jar roll over machines; from the Tabor Mfg. Co., Philadelphia.

Tumbling Barrels

United Shoe Machinery Co., Beverly, Mass.; from the W. W. Sly Mfg. Co., Cleveland.

CHICAGO MARKET

Molding Machines

Hughes Tool Co., Houston, Tex., one; from the Herman Pneumatic Tool Co., Zelienople, Pa.

Sandblast Equipment

Wolverine Brass Works, Grand Rapids, Mich.; mill from the W. W. Sly Mfg. Co., Cleveland.

Sand Perparing Equipment

Kohler Co., Kohler, Wis.; Gillette & Eaton, Inc., Lake City, Minn.; American Hoist & Derrick Co., St. Paul; Allith Prouty Co., Danville, Ill.; Olympic Foundry Co., Seattle; sand mixers from the National Enigneering Co., Chicago.

Standard Foundry Co., Racine, Wis., repeat order for continuous sand mixer; from the Standard Sand & Machine Co., Cleveland, through A. A. Wickland & Co., Inc., Chicago; Omaha Steel Works, continuous mixer with elevator from Standard Sand & Machine Co.

Shakeout Equipment

Griffin Wheel Co., Council Bluffs, Ia., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

Van Brunt Mfg. Co., Horicon, Wis., from the W. W. Sly Mfg. Co., Cleveland.

New Trade Publications

VIBRATING SCREENS—A booklet of instructions for users of its electric vibrating screens has been issued by the W. S. Tyler Co., Cleveland. The instructions cover details of setting up, wiring and adjusting the screens and vibrators, care of screens and vibrators, starting the machine. Specifications are given of the vibrators, sieve tests and screen sections.

METAL COATING—Metals Coating Co. of America has issued a bulletin describing its method of coating metallic products with other metals for protection or ornamentation.

AIR FILTERS—Filters for use in connection with compressors and internal combustion engines form the subject of a bulletin by the Spray Engineering Co., Boston. The filter is built in sections of a size to be handled easily and provision is made for cleansing them easily when clogged. Full specifications are given and the filter is illustrated in units and assembled.

SIFTERS—Mixers, sifters, crushers, grinders, elevators, conveyors and other equipment for conditioning and handling materials are described and illustrated in a bulletin by the

Robinson Mfg. Co., Muncy, Pa. Various types of these devices produced by this company are presented to show their usefulness.

MAGNET CONTROLLER—Ohio Electric & Controller Co., Cleveland, has issued a leaflet describing in detail its newly developed push button master switch for operation of magnetic contractor for lifting magnets. Connection diagrams make clear the construction and operation of the device.

REHEATING FURNACE—Rust Engineering Co., Pittsburgh, has issued a bulletin describing its 4-door recuperative reheating furnace, illustrated by halftones and diagrams covering details and operation.

PYROMETERS—The features and methods of operation of an optical pyrometer manufactured by the Bacharach Industrial Instrument Co., Pittsburgh, are given in a pamphlet just issued. A table describing the applications, method of making determinations, and the corrections to be applied also is given.

ELECTRICAL SUNDRIES—The General Electric Co., Schenectady, N. Y., has issued several pamphlets in the form of loose-leaf catalog pages, showing drum type controllers, automatic voltage starters for synchronous motors, synchronous motor and condenser panels, automatic starters for slip ring induction motors, direct heat electric furnaces.

PULVERIZED FUEL—Unit Pulverizers for industrial furnaces manufactured by the Combustion Engineering Corp., New York, are described in a catalog recently issued. Construction, operation and application of these pulverizers are given.

MOLDING MACHINES—The Osborn Mfg. Co., Cleveland, has issued two pamphlets describing an air operated jolt-squeezer type of molding machine and the method of making molds with this machine. Illustrations and text give the method of operation.

PNEUMATIC TOOLS—Air-driven tools used for grinding, drilling and brushing are shown in a catalog issued by the Warner & Swazey Co., Cleveland. Only three moving parts are claimed to provide economical operation. Illustrations accompanied by text matter show the essential features and uses of the tools.

ROOFS—Building roofs of an assembly of sub-purlins and reinforced roof sheets manufactured by the Truscon Steel Co., Youngstown, O., are described in text and illustration in a catalog recently, issued. A layer of insulation between the steel and the water proofing material is said to provide any desired degree of insulation.

MOTOR CONTROL—The Cutler-Hammer Mfg. Co., Milwaukee, has published a booklet describing electrical progress made in industry. In connection with the increasing use of electricity, improvements in methods of control are cited and illustrated by photographs of installations of the Cutler-Hammer control units.

EQUIPMENT—A recent publication of the Whiting Corp., Harvey, Ill., shows in picture form many of the various types of equipment manufactured by the firm and its subsidiaries. Electric traveling cranes from one to 125 tons, foundry equipment and plant layouts, core oven equipment, overhead trolley systems, cars, trucks and turn tables, air hoists and elevators, side blow converters, screw jack locomotive and coach hoists, pulverized coal systems, evaporators and other chemical machinery are some of the machines and equipment shown in the illustrations.

DRYING AND HEATING—A portable heating device for drying molds and cores on the floor, in pits and in drying rooms, and for heating ladles, shanks, etc. is described in a catalog issued by the International Processes, Ltd., London, England. The device contains two compartments, one containing the fuel and the other is a preheating chamber containing incandescent brick. Air is drawn through both chambers by a jet of compressed air, and the air and gases of combustion are used for heating purposes.

ELECTRIC DRILLS— Various sizes and types of electric drills for different uses are shown in a catalog recently issued by the Independent Pneumatic Tool Co., Chicago. Capacity and attachments for each are given.

FLEXIBLE SHAFTING—An illustrated booklet showing the applications of flexible shafting equipment for industrial purposes recently has been issued by the R. G. Haskins Co., Chicago.

CRANES AND HOISTS—Electric traveling cranes and hoists are depicted in a catalog issued by the Milwaukee Electric Crane & Mfg. Corp., Milwaukee. Features of construction are shown and typical industrial installations are included.

PNEUMATIC TOOLS—The Independent Pneumatic Tool Co., Chicago, has published a catalog describing the various types of pneumatic tools manufactured by this firm. Sizes, speeds and weights of the tools are given. A list of accessories also is included.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Ohio Malleable Iron Works, 1325 Fields avenue, Columbus, O., will build a one-story addition for storage and handling.

Pittsburgh Rolls Corp., Forty-second street, Pittsburgh, is building a one-story plant 73 x 130 feet.

Blue Valley Foundry Co., Kansas City, Mo., has been incorporated with $25,000 capital by C. T. Ludwig, 3715 Harrison street.

Shoultz Brass & Aluminum Foundry Co., St. Louis, has been incorporated by A. G. Nulson, 1424 Pennsylvania avenue.

The Southern Wheel Co., subsidiary of the American Brake Shoe Co., will build a plant at Toledo, O., at an estimated cost of $500,000.

Capitol Iron Works, Topeka, Kans., has let contract for a one-story and foundry addition to cost about $200,000.

The name of the Berkeley Steel Foundry Co., 1328 Second street, Berkeley, Calif., has been changed to the Electric Steel Foundry Co. Inc.

Fire July 23, destroyed the two-story machine shop and four-story pattern shop of the Atlantic Works, Boston, shipbuilders, with loss estimated at $100,000.

Hisey-Wolf Machine Co., Cincinnati, is contemplating erection of a three-story brick addition to its factory at Colerain and Marshall avenues.

G. L. Anderson Brass Works Inc., 831 North Thirty-ninth street, Birmingham, Ala., is building a plant for production of nonferrous castings. (Noted March 1.)

Washington Mold Machine & Foundry Co., Washington, Pa., will build a two-story machine shop 55 x 135 feet on East Bean street. Contract has been let to Grange & Goebel Inc.

Western Foundry & Supply Co., New Britain, Conn., Charles A. Danberg, president and treasurer, has been incorporated to manufacture brass, bronze and aluminum castings.

A. Weiskittle & Son Co., Baltimore, Md., Harry C. Weiskittle, president, Twelfth and East Lombard streets, will build a three-story warehouse.

Atlas Steel Casting Co., 1963 Elmwood avenue, Buffalo, has taken out a permit to rebuild one of its shops recently destroyed by fire, to cost about $17,000. (Noted July 1.)

The Newton Foundry Co., Newton, Iowa, manufacturers of aluminum and light gray iron castings, has completed and now is operating its new 60 x 92-ft. addition.

Jones Hollow Ware Co., 1010 Ashland avenue, Baltimore, is planning to rebuild the portion of its plant recently destroyed by fire with a loss of $200,000.

Beauty Bronze Novelty Co., New York, has been incorporated with $20,000 capital to make bronze castings, by S. Glasner, L. B. Hochmeyer, C. Friend. L. E. Krumholtz, 245 Broadway, is attorney.

Cadillac Malleable Iron Co., Cadillac, Mich., is planning a $250,000 expansion program. An addition will be made immediately to the plant to meet the needs of increased production.

C. E. Homan Co., 1751 Addison street, Chicago, has been incorporated with $50,000 capital to manufacture boilers, engines, machinery, tools, motors, castings and implements by Adelaide J. Homan, Clarence E. Homan, Fred S. Hofmann. Rudolph Shapira, 160 North LaSalle street, is correspondent.

Metropolitan Steel Casting Co., Harrison, N. J., has been incorporated with $100,000 capital to manufacture crucible steel castings, by J. A. Williams, Bergen and Third streets, and J. A. Tedesco.

Canton Furnace & Supply Co., Canton, O., has been incorporated with $200,000 capital to manufacture cast iron and steel furnaces, by J. A. O'Connor, Ninth and Robins court, S. E., J. H. Schlafly, L. J. O'Connor.

The Delco Light Co., Third National Bank building, Dayton, O., has awarded general contract to C. H. Shook, same address, for the first unit of its new plant extension at Moraine City. Building will be one story, 200 x 2600 feet.

The Erie Foundry Co., Erie, Pa., manufacturer of forge shop equipment, has finished a large addition to its machine shop and is ready to occupy same. A new demonstration room and blacksmith shop will be ready in a short time.

Pullman Car & Mfg. Co., Chicago, has purchased a 27-acre plant of the United States Cast Iron Pipe & Foundry Co., at Atlanta, Ga., and will establish repair shops probably at a cost in excess of $1,000,000. The plant will employ from 500 to 1000 men.

Fire recently damaged the Ferndale plant of the Brown-Fayro Co., successor to the Brown Equipment Co., Johnstown, Pa. The firm recently constructed a steel foundry as an addition to the Sheridan plant and the cupola from the Ferndale plant will be removed to the Sheridan plant.